United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
University of Nebraska,
Conservation and Survey
Division

Soil Survey of Banner County, Nebraska

How To Use This Soil Survey

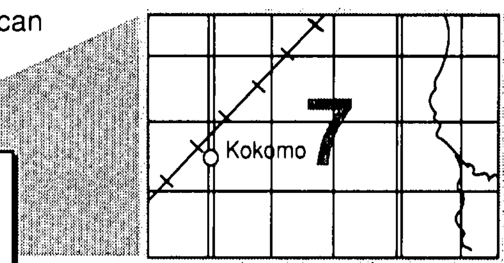
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

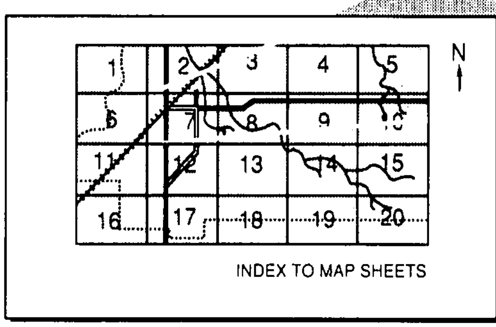
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



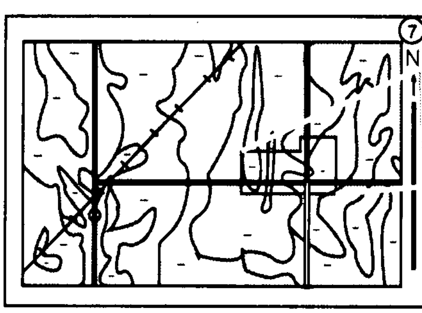
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

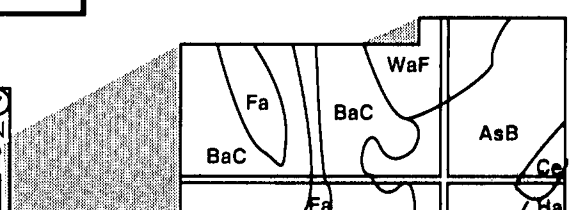


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the North Platte Natural Resources District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: A typical landscape in an area of the Tassel-Busher-Rock outcrop association.

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Foreword

This soil survey contains information that can be used in land-planning programs in Banner County, Nebraska. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Ronald E. Moreland
State Conservationist
Soil Conservation Service

Soil Survey of Banner County, Nebraska

Fieldwork by Wayne J. Vanek, Gary L. McCoy, Norman P. Helzer, J. Cameron Loerch, and Craig R. Derickson, soil scientists, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the University of Nebraska, Conservation and Survey Division

BANNER COUNTY is in western Nebraska (fig. 1). It is bordered on the west by Laramie and Goshen Counties, Wyoming, on the east by Morrill County, Nebraska, on the north by Scotts Bluff County, Nebraska, and on the south by Kimball County, Nebraska. The total area of the county is 478,208 acres, or about 747 square miles. The county is rectangular in shape. It is about 35 miles from east to west and about 21 miles from north to south. Harrisburg, the county seat, is the only town in the county.

In 1980, the population of the county was 1,018. Nearly all of the residents are engaged in agriculture or agriculturally related occupations. Oil production also is important to the economy of the county (fig. 2). Winter wheat is the main dryland crop. Corn, wheat, and alfalfa are the main irrigated crops. About 50 percent of the land supports native grasses and is used for grazing or hayland.

This soil survey updates the survey of Banner County published in 1921 *(5)*. It gives additional information and has larger maps, which show the soils in greater detail.

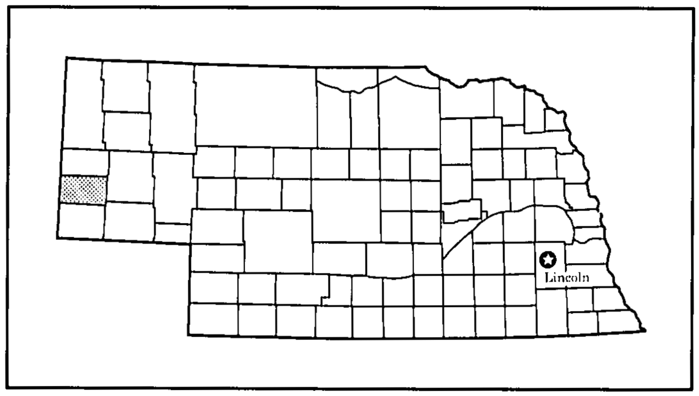

Figure 1.—Location of Banner County in Nebraska.

General Nature of the County

This section provides general information about Banner County. It describes history and development; climate; physiography, relief, and drainage; geology and ground water; and trends in agriculture.

History and Development

Locally discovered artifacts indicate that several Indian nations were the first inhabitants of Banner County. In about 1830, the first Europeans arrived in the area. They were fur trappers.

In 1867, the completion of the Union Pacific Railroad at Sidney, Nebraska, brought many settlers to the county. Pumpkin Creek, which is in a large stream valley, attracted many ranchers and homesteaders to the area. Initially, large open-range ranches dominated the area, but the herd laws of 1870 and 1887 forced the big cattle companies to move to new range in Wyoming. The first homestead settlement was in 1884. The boundaries of Banner County were established in 1888, when the Cheyenne County Territory was divided into smaller areas *(3)*.

The first oil-producing well in the county was drilled in 1951 near Harrisburg. From 1955 through 1963,

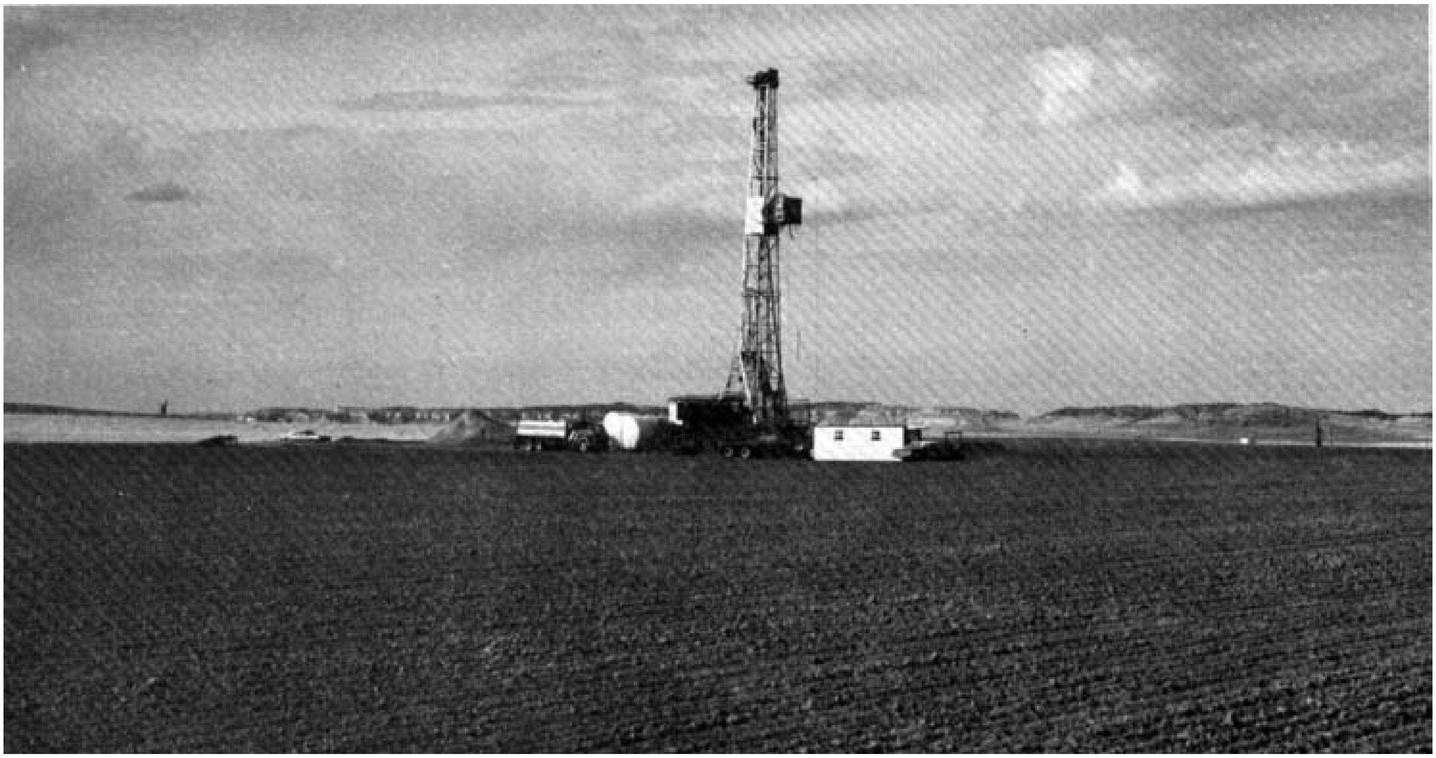

Figure 2.—An oil well in an area of Tripp very fine sandy loam, 1 to 3 percent slopes.

nearly 50 percent of the economy was based on oil production. In 1981, more than 200 oil wells provided nearly 17 percent of the income in the county.

Good transportation facilities, including commercial air services, are available in nearby Scottsbluff. Commercial truck service is available from Scottsbluff to Harrisburg.

The county has two major highways. Nebraska State Highway 71 provides a north-south route through the center of the county. It connects to Nebraska State Highway 88 in the eastern part of the county. It is connected to Harrisburg by a state spur. Roads that are rural mail routes and school bus routes typically have a gravel surface. Few roads have been developed in the upland breaks and the Wildcat Ridge area.

Climate

Banner County is usually warm in summer with frequent hot days. In winter, periods of very cold weather are caused by arctic air moving in from the north or northeast. Cold periods alternate with milder periods that occur often when westerly winds are warmed as they move downslope. Most of the precipitation in the county is rain that falls during the warmer part of the year. The rainfall is normally heaviest in late spring and early summer. Winter snowfalls are frequent, but the snow cover usually disappears during the mild periods. During some years, a heavy blizzard with high winds and drifting snow strikes the area and snow remains on the ground for many weeks. During some summers, hailstorms cause severe damage to crops in the area.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Harrisburg, Nebraska, in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 27 degrees F and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Harrisburg on January 19, 1963, is -35 degrees. In summer, the average temperature is 68 degrees and the average daily maximum temperature is 83 degrees. The highest recorded temperature, which occurred at Harrisburg on July 30, 1980, is 102 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing

degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 14 inches. Of this, nearly 11 inches, or about 80 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 5 inches. The heaviest 1-day rainfall during the period of record was 2.77 inches at Harrisburg on July 29, 1957. Thunderstorms occur on about 44 days each year.

The average seasonal snowfall is about 47 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 40 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 45 percent. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter.

Physiography, Relief, and Drainage

Banner County is in the High Plains region of the Great Plains physiographic province. The Laramie Range of the Rocky Mountains is within about 70 miles of the western boundary of the county *(6)*. The Cheyenne Tableland is a high plain remnant of the Laramie Range. It slopes eastward to central Nebraska and covers the southern third of Banner County. Much of this tableland is mantled with loess. A 200- to 400-foot-high escarpment overlooking the Pumpkin Creek valley is the northern boundary of the remnant. The elevation of the Cheyenne Tableland along the Nebraska-Wyoming State line is about 5,340 feet. The elevation drops to about 3,840 feet in the extreme northeast corner of the county in an area adjacent to the North Platte River.

The narrow, steep-sided Wildcat Ridge forms the northern side of Pumpkin Creek valley. In some areas it is 700 to 750 feet higher than Pumpkin Creek or 100 to 200 feet lower than the tableland to the south of the valley. The Wildcat Ridge is a highly eroded remnant of the High Plains. It parallels Pumpkin Creek from southwestern Scotts Bluff County to western Morrill County.

Pumpkin Creek is in a broad valley that was probably originally formed by Horse Creek, a large, ancient, meandering stream. Currently, Horse Creek drains a very large area of southeastern Wyoming and empties into the North Platte River in western Scotts Bluff County. The lowland area of the Pumpkin Creek valley is an eastern extension of the Goshen Hole lowland area in eastern Wyoming. The southern side of this broad valley has several levels and series of dissected terraces.

Nearly all of Banner County is drained by Pumpkin Creek and Lawrence Fork and their tributaries. Most of the Cheyenne Tableland in the southern part of the county is drained by Rocky Hollow, a tributary of Lawrence Fork. The terrain is very rugged near the eastern county line where the Rocky Hollow drainage enters the Lawrence Fork drainage.

The volume of water in Pumpkin Creek and its tributaries is dependent on the seepage of ground water from nearby rock sediments that yield water and on surface runoff that occurs after storms.

A small area in the southern part of the county is drained by tributaries of Lodgepole Creek that flow to the southeast. Lodgepole Creek is located in Kimball County.

Geology and Ground Water

Wells in Banner County provide water for livestock, for domestic use, and, in places, for irrigation. The ground water, however, is not uniformly distributed throughout the county. Pierre Shale of Cretaceous age underlies the county. It consists of black and bluish gray shale that does not yield water to wells.

The oldest recognized Cenozoic rocks in Banner County are the Chadron Formation and the Brule Formation of the White River Group of Oligocene age. The Chadron Formation, the oldest Cenozoic unit in Banner County, consists of clay, silt, siltstone, and sand. This formation is mostly fine textured, but it contains locally thick deposits of coarse textured sediments capable of yielding water to wells. This water is under pressure, and when a well is drilled, the water level rises. The Brule Formation overlies the Chadron Formation. It is composed of calcareous siltstone, large amounts of volcanic ash, and small amounts of fine sand. The Brule Formation is exposed in many places on the floor of Pumpkin Creek valley (fig. 3). It also is exposed on the lower part of the side slopes of Wildcat Ridge, the lower part of the north escarpment of the Cheyenne Tableland, and the lower slopes of the dissected area in the southeastern part of the county. The Brule Formation is a important local source of ground water. In parts of Pumpkin Creek valley, the Brule Formation yields water along intersecting fractures. Most productive wells in the Brule Formation are located in low areas that receive drainage from a

Figure 3.—An exposure of Brule siltstone showing the characteristic blocky structure.

large area. Yields from wells in this unit, however, generally decrease rapidly because water stored in the fractures is soon depleted.

The Arikaree Group of Miocene age (fig. 4), which is the next youngest unit after the Brule Formation, is exposed in the county. It crops out on Wildcat Ridge along parts of the north-facing escarpment of the Cheyenne Tableland and also on the slopes of the dissected area in the southeastern part of the county *(4)*.

The Arikaree Group is composed of gravel, very fine to fine sandstone and some medium grained sandstone, silt, siltstone, and volcanic ash. The sandstone beds are so fine textured that they are only slowly permeable to moderately permeable. Irrigation wells for small acreages can be located in areas where the thickness of the saturated zone of the Arikaree Group is 100 feet or more.

The Ogallala Group of Miocene age is the youngest stratigraphic unit of the Tertiary period. It is composed of gravelly sand, sand, sandstone, silt, siltstone, limestone, diatomite, and volcanic ash. Much of the Ogallala Group in the county has been eroded. The Ogallala Group is likely to include a significant thickness of saturated material only in areas where it is in a deep valley cut into the pre-Ogallala Formation.

Unconsolidated deposits of Quaternary age occur in many places in the county. They consist of stream alluvium, colluvium, and windblown material. They absorb precipitation readily and transmit water to the underlying Brule Formation and, in a few places, supply water to wells.

The primary chemical compounds of water are sodium bicarbonate in the Chadron Formation and older units, calcium-sodium bicarbonate in the Brule Formation, and calcium bicarbonate in the younger units. The pH of the water ranges from mildly alkaline to very strongly alkaline (7.4 to 9.2).

Trends in Agriculture

Banner County was once a short grass prairie and open range. Rangeland was the most important land use. As settlers moved west and railroads were built, large ranches were replaced by small farms. Initially, agricultural development was very slow because of the inaccessibility of market places, the unfavorable climatic conditions, and the destruction of crops by insects.

Because drought and high winds in the 1930's caused widespread crop failure and severe soil losses, the application of soil and water conservation practices was encouraged. In 1949, the Banner County Soil Conservation District was formed. The North Platte Natural Resource District now assists land users in resource conservation practices.

Winter wheat is the major crop in Banner County and is planted on nearly 59,000 acres. Other grain crops grown are corn, oats, barley, millet, and rye. In 1987, more than 24,000 acres was planted to these five crops. Dry beans, potatoes, and sunflowers are other minor crops.

About 15 percent of the cropland in the county is irrigated. In 1987, the county had 248 registered wells. Development of irrigation has resulted in the lowering of the water table in the Pumpkin Creek valley. This lower water table is becoming a major management concern.

Figure 4.—An exposure of pipy concretions in the Monroe-Harrison Formation of the Arikaree Group.

In 1987, the livestock in the county consisted of about 29,700 cattle, 11,000 sheep, and 1,700 hogs.

The current trend in agriculture indicates that family farms will become larger in size but be fewer in number. Technological improvements in equipment, more efficient irrigation systems, and extensive use of pesticides and fertilizers result in the potential for increased yields. The modern progressive farm operated under intensive management and computerized technology has become a more specialized business operation.

Many old homesteads and the surrounding trees and brush have been cleared away in order to increase the size of cultivated fields and the acreage in production. The loss of permanent cover has decreased wildlife populations. Soil blowing and water erosion are hazards

on the fertile soils in the county. Effective modern conservation measures can be designed to help control erosion and to provide habitat for wildlife.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Some of the boundaries on the soil maps of Banner County do not match those on the soil map of adjacent counties, and some of the soil names and descriptions do not fully agree. The differences are a result of improvements in the classification of soils, particularly modifications or refinements in soil series concepts. Also, there may be differences in the intensity of mapping or in the extent of the soils within the survey area.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Soil Descriptions

Nearly Level to Very Steep, Loamy Soils on Uplands

These soils are deep and shallow, are nearly level to very steep, and are well drained and somewhat excessively drained. Most of the soils are used for dryland farming. A small acreage is in native grass and used for grazing. Soil blowing and water erosion are the principal hazards. Maintaining fertility and controlling erosion are the main management concerns in cultivated areas. Maintaining good range condition is the main management concern in areas of rangeland.

1. Alliance-Keith-Sidney Association

Deep, nearly level to moderately steep, well drained, loamy soils; on uplands

This association consists mainly of soils on upland divides, ridgetops, and side slopes. Slopes range from 0 to 20 percent.

This association has a total area of 100,000 acres, which is about 21 percent of the county. It is about 31 percent Alliance soils, 17 percent Keith soils, 17 percent Sidney soils, and 35 percent minor soils (fig. 5).

Alliance soils are nearly level to strongly sloping. They formed in loess and in the underlying calcareous sandstone bedrock. Typically, the surface layer is grayish brown, very friable loam about 8 inches thick. The subsoil is about 19 inches thick. It is grayish brown and brown, friable clay loam in the upper part; brown, very friable loam in the next part; and pale brown, calcareous loam in the lower part. The underlying material extends to a depth of 44 inches. It is very pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of 44 inches.

Keith soils are nearly level to gently sloping. They formed in loess. Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer also is grayish brown, very friable loam. It is about 3 inches thick. The subsoil is about 20 inches thick. It is brown, friable silty clay loam in the upper part; pale brown, friable loam in the next part; and very pale brown, very friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam.

Sidney soils are gently sloping to moderately steep. They formed in loamy, calcareous material and the underlying calcareous sandstone bedrock. Typically, the surface layer is grayish brown, very friable, calcareous loam about 7 inches thick. The subsoil is about 19 inches thick. It is brown, very friable, calcareous very fine sandy loam in the upper part and light brownish gray, very friable, calcareous silt loam in the lower part. The underlying material extends to a depth of 48 inches. It is very pale brown, calcareous very fine sandy loam. White, calcareous sandstone bedrock is at a depth of 48 inches.

Of minor extent in this association are Altvan, Canyon, Duroc, Eckley, and Rosebud soils. Altvan, Canyon, Eckley, and Rosebud soils are in landscape positions similar to those of the major soils. Altvan and Eckley soils are moderately deep or shallow over gravelly coarse sand or very gravelly sand. Canyon and Rosebud soils are shallow or moderately deep over sandstone bedrock. Duroc soils have a surface soil that

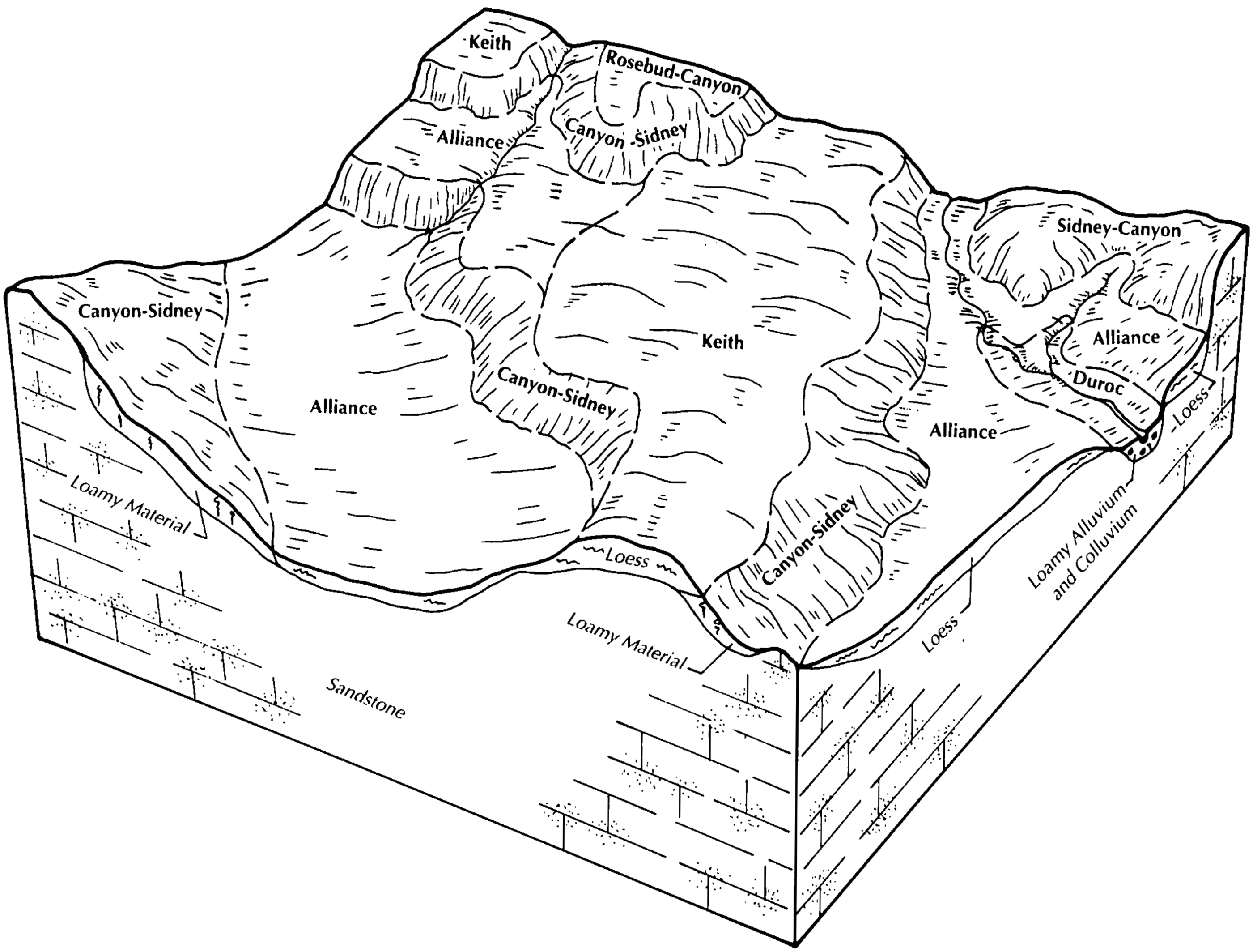

Figure 5.—Typical pattern of soils and parent material in the Alliance-Keith-Sidney association.

is thicker than that of the major soils. They are in upland swales.

The major soils in this association are used mainly as cropland. The main crop is winter wheat. The soils are mainly dry-farmed because a sufficient supply of water generally is not available for irrigation.

Water erosion and soil blowing are the main hazards. A system of conservation tillage that leaves crop residue on the surface and cover crops help to control water erosion and soil blowing and conserve soil moisture. Conserving soil moisture, increasing the content of organic matter, and maintaining tilth and fertility are management concerns.

2. Satanta-Alliance-Canyon Association

Deep and shallow, nearly level to moderately steep, well drained, loamy soils; on uplands

This association consists of soils on ridgetops and side slopes in the uplands. Slopes range from 0 to 20 percent.

This association has a total area of 41,600 acres, which is about 9 percent of the county. It is about 33 percent Satanta soils, 11 percent Alliance soils, 11 percent Canyon soils, and 45 percent minor soils.

Satanta soils are very gently sloping and gently sloping. They formed in loamy eolian material on broad

divides and side slopes. Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsoil is about 20 inches thick. It is brown, firm sandy clay loam in the upper part; pale brown, firm sandy clay loam in the next part; and pale brown, calcareous loam in the lower part. The underlying material extends to a depth of 60 inches or more. It is very pale brown, calcareous fine sandy loam in the upper part and pale brown, calcareous loamy fine sand in the lower part.

Alliance soils are nearly level to strongly sloping. They formed in loess and in the underlying calcareous sandstone bedrock. They are on broad divides and side slopes in the uplands. Typically, the surface layer is grayish brown, very friable loam about 8 inches thick. The subsoil is about 19 inches thick. It is grayish brown and brown, friable clay loam in the upper part; brown, very friable loam in the next part; and pale brown, calcareous loam in the lower part. The underlying material extends to a depth of 44 inches. It is very pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of 44 inches.

Canyon soils are gently sloping to moderately steep. They formed in loamy material weathered from calcareous sandstone bedrock. They are on the upper side slopes and ridgetops in the uplands. Typically, the surface layer is grayish brown, very friable, calcareous loam about 6 inches thick. The underlying material extends to a depth of 14 inches. It is pale brown, very friable, calcareous loam. White, calcareous sandstone bedrock is at a depth of 14 inches.

Of minor extent in this association are Altvan, Creighton, Duroc, Keith, and Sidney soils. Altvan soils are moderately deep over gravelly coarse sand. They are on ridgetops and the upper side slopes. Creighton and Sidney soils have less clay than the Alliance and Satanta soils. They are in landscape positions similar to those of the Alliance and Satanta soils. Duroc soils have a surface soil that is thicker than that of the major soils. They are in upland swales. Keith soils formed in loess. They are in landscape positions similar to those of the major soils.

The major soils in this association are used as cropland or range. Winter wheat is the main crop. The soils are mainly dry-farmed because a sufficient supply of water for irrigation generally is not available. Some areas support native grasses and are used as range.

Soil blowing and water erosion are the main hazards in cultivated areas. A system of conservation tillage that leaves crop residue on the surface and cover crops help to control soil blowing and water erosion and conserve soil moisture. Increasing the content of organic matter and maintaining tilth and fertility are management concerns.

3. Canyon-Rock Outcrop Association

Rock outcrop and shallow, moderately steep to very steep, well drained and somewhat excessively drained, loamy soils; on uplands

This association consists of soils on narrow upland ridges, shoulder slopes, and side slopes that are dissected by drainageways. Slopes range from 9 to 60 percent.

This association has a total area of 33,000 acres, which is about 7 percent of the county. It is about 38 percent Canyon soils, 14 percent Rock outcrop, and 48 percent minor soils.

Canyon soils are moderately steep to very steep. They formed in loamy material that is shallow over calcareous sandstone bedrock. They are on the narrow ridgetops, shoulders, and upper side slopes in the uplands. Typically, the surface layer is grayish brown, very friable, calcareous loam about 6 inches thick. The underlying material extends to a depth of 14 inches. It is pale brown, very friable, calcareous loam. White, calcareous sandstone bedrock is at a depth of 14 inches.

The areas of Rock outcrop are on the dissected upland side slopes, narrow ridgetops, and upper side slopes. The Rock outcrop is dominantly fine grained sandstone, but in places it is siltstone.

Of minor extent in this association are Altvan, Bankard, Bayard, Eckley, Epping, Glenberg, and Sidney soils. Bankard and Glenberg soils are on bottom land. Bayard soils are on foot slopes. Altvan and Eckley soils are moderately deep or shallow over very gravelly sand or gravelly coarse sand. They are on dissected upland ridgetops. Epping soils are shallow over siltstone bedrock. They are on dissected side slopes and narrow ridgetops. Sidney soils are deep. They are on side slopes.

The major soils in this association are used mostly as range. The soils generally are not suited to cultivated crops because of the slope and the shallow root zone. Ponderosa pine commonly grows on the steeper slopes.

Soil blowing and water erosion are hazards. A cover of range plants is effective in controlling soil blowing and water erosion. Proper grazing use, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition.

Nearly Level to Very Steep, Sandy Soils on Uplands

These soils are shallow and deep, are nearly level to very steep, and are well drained to excessively drained.

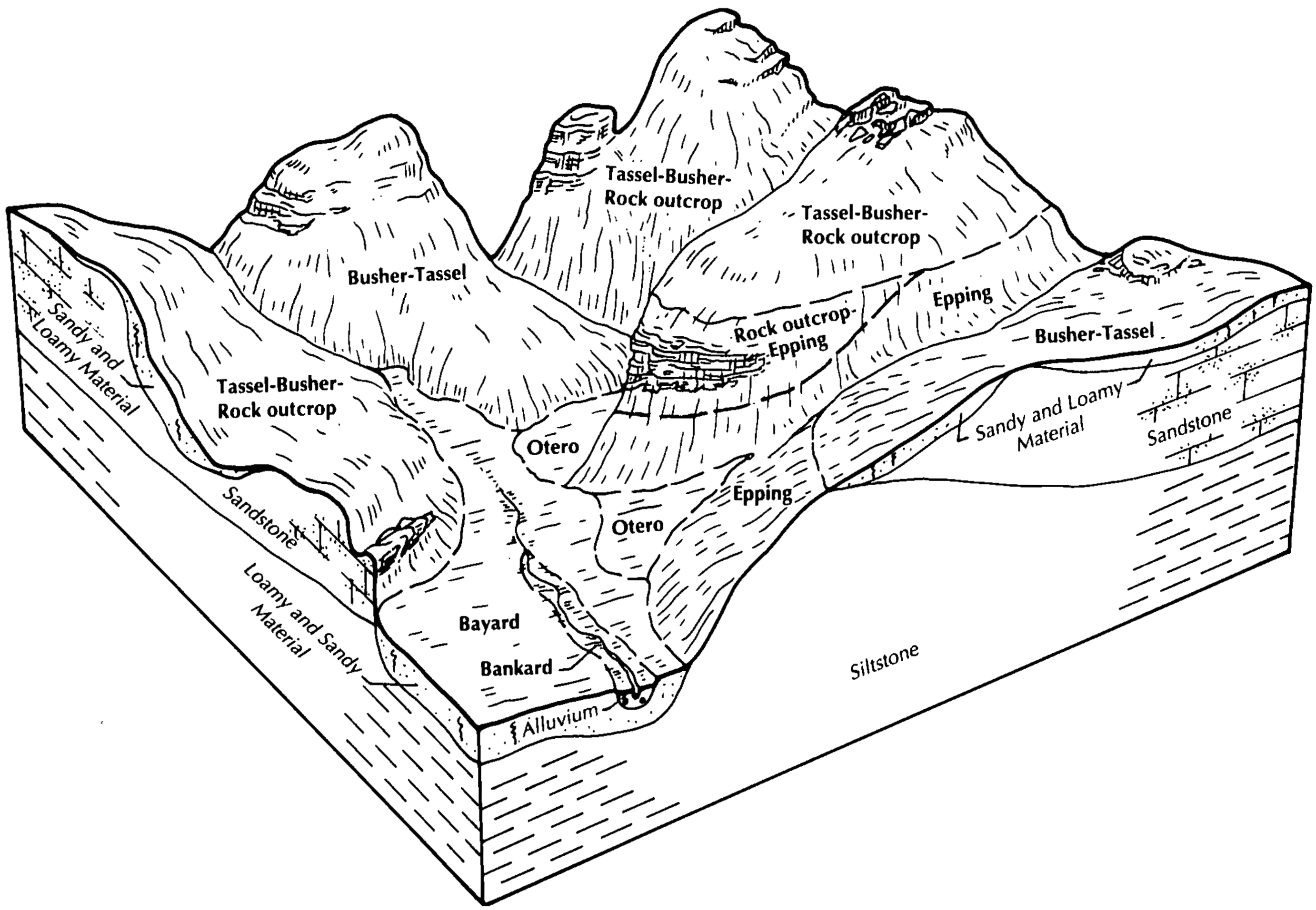

Figure 6.—Typical pattern of soils and parent material in the Tassel-Busher-Rock outcrop association.

Most of the soils support native grasses and are used for grazing. A small acreage is used for cultivated crops. Soil blowing is a hazard in cultivated areas. Maintaining good range condition is the main management concern in areas of rangeland.

4. Tassel-Busher-Rock Outcrop Association

Rock outcrop and shallow and deep, moderately steep to very steep, well drained and somewhat excessively drained, sandy soils; on uplands

This association consists mainly of soils and areas of Rock outcrop on narrow upland ridges, shoulders, and side slopes. Slopes range from 9 to 60 percent.

This association has a total area of 72,500 acres, which is about 14 percent of the county. It is about 45 percent Tassel soils, 21 percent Busher soils, 17 percent Rock outcrop, and 17 percent minor soils (fig. 6).

Tassel soils are moderately steep to very steep. They formed in sandy and loamy material that is shallow over sandstone bedrock. They are on narrow ridgetops, shoulders, and dissected upper side slopes. Typically, the surface layer is pale brown, very friable, calcareous loamy very fine sand about 7 inches thick. The underlying material extends to a depth of 15 inches. It is pale brown, calcareous loamy very fine sand. White, calcareous sandstone bedrock is at a depth of 15 inches.

Busher soils are moderately steep and steep. They formed in sandy and loamy material weathered from sandstone bedrock. They are mostly on the mid and lower side slopes. Typically, the surface layer is grayish brown, very friable loamy very fine sand about 7 inches thick. The subsoil is light brownish gray, very friable loamy very fine sand about 11 inches thick. The underlying material extends to a depth of 48 inches. It is light brownish gray loamy very fine sand in the upper

part and light gray, calcareous loamy very fine sand in the lower part. White, calcareous sandstone bedrock is at a depth of 48 inches.

The areas of Rock outcrop are on the narrow ridgetops, upper side slopes, and shoulders of dissected uplands. The Rock outcrop is dominantly fine grained sandstone, but in places it is siltstone.

Of minor extent in this association are the Bankard, Bayard, Bridget, Eckley, Epping, and Otero soils. Bankard soils are on bottom land. Bayard, Bridget, and Otero soils are on foot slopes. Eckley soils are shallow over very gravelly sand. They are on dissected ridgetops. Epping soils are shallow over siltstone bedrock. They are on dissected side slopes and narrow ridgetops.

The major soils in this association support native grasses and are used as range. The soils generally are not suited to cultivated crops because of the slope and the shallow root zone. Ponderosa pine commonly grows on the steeper slopes.

Soil blowing and water erosion are hazards. A cover of range plants is effective in controlling soil blowing and water erosion. Proper grazing use, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition.

5. Valent Association

Deep, nearly level to steep, excessively drained, sandy soils; on uplands

This association consists of soils on hummocky dunes. Slopes range from 3 to 24 percent.

This association has a total area of 6,300 acres, which is about 1 percent of the county. It is 79 percent Valent soils and 21 percent minor soils.

Valent soils formed in sandy eolian material. Typically, the surface layer is grayish brown, very friable loamy fine sand about 4 inches thick. Next is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material extends to a depth of 60 inches or more. It is light brownish gray fine sand.

Of minor extent in the association are Alice, Busher, Mitchell, Otero, Sarben, Tassel, and Vetal soils. Alice and Sarben soils are on stream terraces. Busher and Tassel soils have less sand than the Valent soils. They are on uplands. Mitchell soils are on foot slopes. Otero soils are on valley sides and alluvial fans. Vetal soils are in swales and along drainageways.

The Valent soils support native grasses and are used mainly as range. A few small areas of these soils are used for irrigated crops. The soils generally are not suited to cultivated crops because of the slope, soil blowing, and droughtiness.

A cover of range plants is effective in controlling soil blowing and water erosion. Proper grazing use, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition.

6. Valent-Sarben Association

Deep, nearly level to steep, well drained and excessively drained, sandy soils; on uplands

This association consists mainly of soils on hummocks and dunes. Slopes range from 0 to 24 percent.

This association has a total area of 7,200 acres, which is about 2 percent of the county. It is about 38 percent Valent soils, 33 percent Sarben soils, and 29 percent minor soils.

Valent soils are excessively drained. They are nearly level to steep. They formed in sandy eolian material. Typically, the surface layer is grayish brown, very friable loamy fine sand about 4 inches thick. Next is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material extends to a depth of 60 inches or more. It is light brownish gray, loose fine sand.

Sarben soils are well drained. They are nearly level to strongly sloping. They formed in loamy eolian material. Typically, the surface layer is brown, very friable loamy very fine sand about 7 inches thick. Next is a transitional layer of pale brown, very friable loamy very fine sand about 9 inches thick. The underlying material extends to a depth of 60 inches or more. It is very pale brown loamy very fine sand. It is calcareous in the lower part.

Of minor extent in this association are Alice, Bayard, Dix, Otero, and Vetal soils. Alice soils are on stream terraces. Bayard and Otero soils are on foot slopes and alluvial fans. Dix soils are on high stream terraces, on breaks to stream terraces, and on foot slopes. Vetal soils are on foot slopes and in swales.

The major soils in this association mainly support native grasses and are used as range. In some areas the soils are used for dryland crops or irrigated crops. The main irrigated crops are corn; dry, edible beans; and alfalfa. Winter wheat is the main dryland crop.

Soil blowing and water erosion are the main hazards. A cover of range plants is effective in controlling soil blowing and water erosion. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to maintain or improve the range condition. A system of conservation tillage that leaves crop residue on the surface and cover crops help to control soil blowing and water erosion and conserve soil moisture. Increasing the content of organic matter and maintaining tilth and fertility are management concerns.

Nearly Level to Moderately Steep, Loamy and Sandy Soils on Foot Slopes, Alluvial Fans, and Stream Terraces and in Swales

These soils are deep, are nearly level to moderately steep, and are well drained. About half the acreage is dryland farmed. The rest is range that is used for grazing. A small part of this acreage is irrigated. Soil blowing and water erosion are the principal hazards. Using irrigation water efficiently, maintaining fertility, and controlling erosion are the main management concerns in cultivated areas. Maintaining good range condition is the main management concern in areas of rangeland.

7. Bridget-Otero Association

Deep, nearly level to moderately steep, well drained, loamy and sandy soils; on foot slopes, alluvial fans, and stream terraces

This association consists of soils on foot slopes and alluvial fans in the Pumpkin Creek valley. Slopes range from 0 to 20 percent.

This association has a total area of 16,100 acres, which is about 3 percent of the county. It is about 37 percent Bridget soils, 30 percent Otero soils, and 33 percent minor soils.

Bridget soils formed in loamy sediments. Typically, the surface layer is brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer is grayish brown, very friable very fine sandy loam about 7 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is pale brown in the upper part and very pale brown in the lower part.

Otero soils formed in loamy and sandy sediments. Typically, the surface layer is brown, very friable, calcareous loamy very fine sand about 5 inches thick. Next is a transitional layer of pale brown, very friable, calcareous loamy very fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is calcareous loamy very fine sand. It is pale brown in the upper part and very pale brown in the lower part.

Of minor extent in this association are Bayard, Epping, Mitchell, Sarben, Valent, and Vetal soils. Bayard, Mitchell, and Vetal soils are on foot slopes. Epping soils are on knolls, dissected side slopes, and narrow ridgetops. Sarben soils are on stream terraces and valley side slopes. Valent soils are on dunes.

The major soils in this association are used mainly for diversified farming. Most of the cropland is irrigated, although some is dry-farmed. The main irrigated crops are corn; dry, edible beans; and alfalfa. Winter wheat is the main dryland crop. Areas where water is unavailable for irrigation or that have a steep slope support native grasses and are used for grazing.

Soil blowing and water erosion are hazards in cultivated areas. A system of conservation tillage that leaves crop residue on the surface and cover crops help to control water erosion and soil blowing and conserve soil moisture. Increasing the content of organic matter and maintaining tilth and fertility are management concerns.

8. Bayard-Bridget Association

Deep, nearly level to moderately steep, well drained, loamy soils; on foot slopes, alluvial fans, and stream terraces

This association consists of soils on foot slopes and alluvial fans in the Pumpkin Creek valley. Slopes range from 0 to 20 percent.

This association has a total area of 73,000 acres, which is about 15 percent of the county. It is about 27 percent Bayard soils, 21 percent Bridget soils, and 52 percent minor soils.

Bayard soils formed in loamy and sandy sediments. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 4 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is light brownish gray in the upper part and pale brown in the lower part.

Bridget soils formed in loamy sediments. Typically, the surface layer is brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer is grayish brown, very friable very fine sandy loam about 7 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is pale brown in the upper part and very pale brown in the lower part.

Of minor extent in this association are Bankard, Dix, Epping, Mitchell, Otero, Sarben, and Valent soils. Bankard soils are on bottom land. Dix and Epping soils are on knolls, dissected side slopes, and narrow ridgetops. Mitchell and Otero soils have a surface soil that is thinner than that of the major soils. They are in landscape positions similar to those of the major soils. Sarben soils are on stream terraces and valley side slopes. Valent soils are on dunes.

The major soils in this association are used as cropland or range. Most cultivated areas are irrigated, although some areas are dry-farmed. The main irrigated

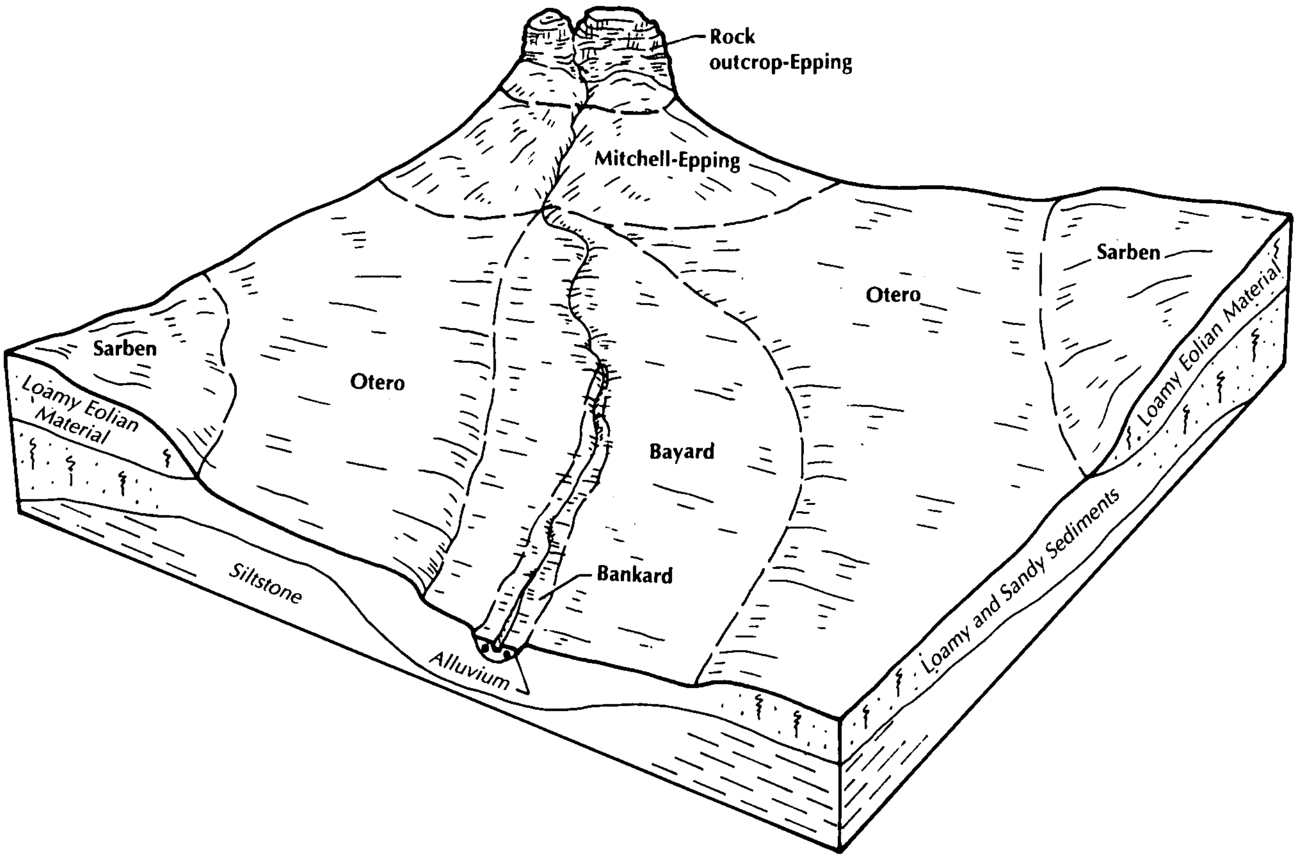

Figure 7.—Typical pattern of soils and parent material in the Otero-Bayard-Sarben association.

crops are corn; dry, edible beans; and alfalfa. Winter wheat is the main dryland crop. A few areas support introduced grasses that are used as pasture or are cut for hay. Areas where water is unavailable for irrigation or that have a steep slope support native grasses and are used for grazing.

Soil blowing and water erosion are the main hazards in cultivated areas. A system of conservation tillage that leaves crop residue on the surface and cover crops help to control water erosion and soil blowing and conserve soil moisture. Increasing the content of organic matter and maintaining tilth and fertility are management concerns.

9. Otero-Bayard-Sarben Association

Deep, nearly level to moderately steep, well drained, loamy and sandy soils; on foot slopes, alluvial fans, and stream terraces

This association consists mainly of soils on foot slopes, alluvial fans, and stream terraces. Slopes range from 0 to 20 percent.

This association has a total area of 47,000 acres, which is about 10 percent of the county. It is about 25 percent Otero soils, 20 percent Bayard soils, 17 percent Sarben soils, and 38 percent minor soils (fig. 7).

Otero soils are nearly level to moderately steep. They formed in loamy and sandy sediments on foot slopes and alluvial fans. Typically, the surface layer is brown, very friable, calcareous loamy very fine sand about 5 inches thick. Next is a transitional layer of pale brown, very friable, calcareous loamy very fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is calcareous loamy very fine sand. It is pale brown in the upper part and very pale brown in the lower part.

Bayard soils are nearly level to moderately steep. They formed in loamy and sandy sediments on foot slopes. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 4 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 8 inches thick. The

underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is light brownish gray in the upper part and pale brown in the lower part.

Sarben soils are nearly level to strongly sloping. They formed in loamy eolian material on stream terraces. Typically, the surface layer is brown, very friable loamy very fine sand about 7 inches thick. Next is a transitional layer of pale brown, very friable loamy very fine sand about 9 inches thick. The underlying material extends to a depth of 60 inches or more. It is very pale brown loamy very fine sand. It is calcareous in the lower part.

Of minor extent in this association are Bankard, Bridget, Dix, Epping, Mitchell, and Valent soils and areas of rock outcrop. Bankard soils formed in alluvium on bottom land. Bridget and Mitchell soils have less sand than the major soils. They are in landscape positions similar to those of the major soils. Dix and Epping soils are on knolls, dissected side slopes, and narrow ridgetops. Valent soils are on dunes.

The major soils in this association are used mainly as cropland. The areas not used as cropland support native grasses and are used for grazing. Most of the cropland is irrigated, although some areas are dry-farmed. The main irrigated crops are corn; dry, edible beans; and alfalfa. Winter wheat is the main dryland crop. A few areas support introduced grasses that are used as pasture or are cut for hay. Areas where water is unavailable for irrigation or that have a steep slope commonly support native grasses and are used as range.

Soil blowing and water erosion are hazards in cultivated areas. A system of conservation tillage that leaves crop residue on the surface and cover crops help to control water erosion and soil blowing and conserve soil moisture. Increasing the content of organic matter and maintaining tilth and fertility are management concerns.

10. Tripp-Alice Association

Deep, nearly level to strongly sloping, well drained, loamy and sandy soils; on stream terraces

This association consists of soils on stream terraces (fig. 8). Slopes range from 0 to 9 percent.

This association has a total area of 57,500 acres, which is about 12 percent of the county. It is about 53 percent Tripp soils, 24 percent Alice soils, and 23 percent minor soils.

Tripp soils formed in loamy alluvium and loess. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 7 inches thick. The subsurface layer is brown, very friable very fine sandy loam about 5 inches thick. The subsoil is about 18 inches thick. It is pale brown, very friable very fine sandy loam in the upper part and light gray, very friable, calcareous silt loam in the lower part. The underlying material extends to a depth of 60 inches or more. It is very pale brown, calcareous very fine sandy loam.

Alice soils formed in loamy and sandy sediments. Typically, the surface layer is grayish brown, very friable fine sandy loam about 7 inches thick. The subsurface layer also is grayish brown, very friable fine sandy loam. It is about 3 inches thick. The subsoil is about 20 inches thick. It is brown, very friable fine sandy loam in the upper part and light gray, very friable, calcareous fine sandy loam in the lower part. The underlying material extends to a depth of 60 inches or more. It is light gray, calcareous fine sandy loam.

Of minor extent in this association are Bankard, Bayard, Dix, Glenberg, Sarben, Valent, and Vetal soils. Bankard and Glenberg soils are on bottom land. Bayard and Vetal soils are on foot slopes and alluvial fans. Dix soils are on breaks to stream terraces. Sarben and Valent soils are on dunes.

The major soils in this association are used as cropland or range. Most cultivated areas are dry-farmed. Winter wheat is the main dryland crop. The main irrigated crops are corn; dry, edible beans; and alfalfa. The rangeland supports native grasses and is used for grazing.

Soil blowing and water erosion are hazards in cultivated areas. A system of conservation tillage that leaves crop residue on the surface and cover crops help to control water erosion and soil blowing and conserve soil moisture. Increasing the content of organic matter and maintaining tilth and fertility are management concerns.

11. Vetal-Bayard Association

Deep, nearly level and very gently sloping, well drained, loamy soils; on foot slopes and in swales

This association consists of soils that formed in loamy and sandy sediments. Slopes range from 0 to 3 percent.

This association has a total area of 13,500 acres, which is about 3 percent of the county. It is about 41 percent Vetal soils, 22 percent Bayard soils, and 37 percent minor soils.

Vetal soils are on foot slopes and in swales. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 25 inches thick. Next is a transitional layer of light brownish gray, very friable very fine sandy loam about 10 inches thick. The underlying material extends to a depth of 60 inches or more. It is

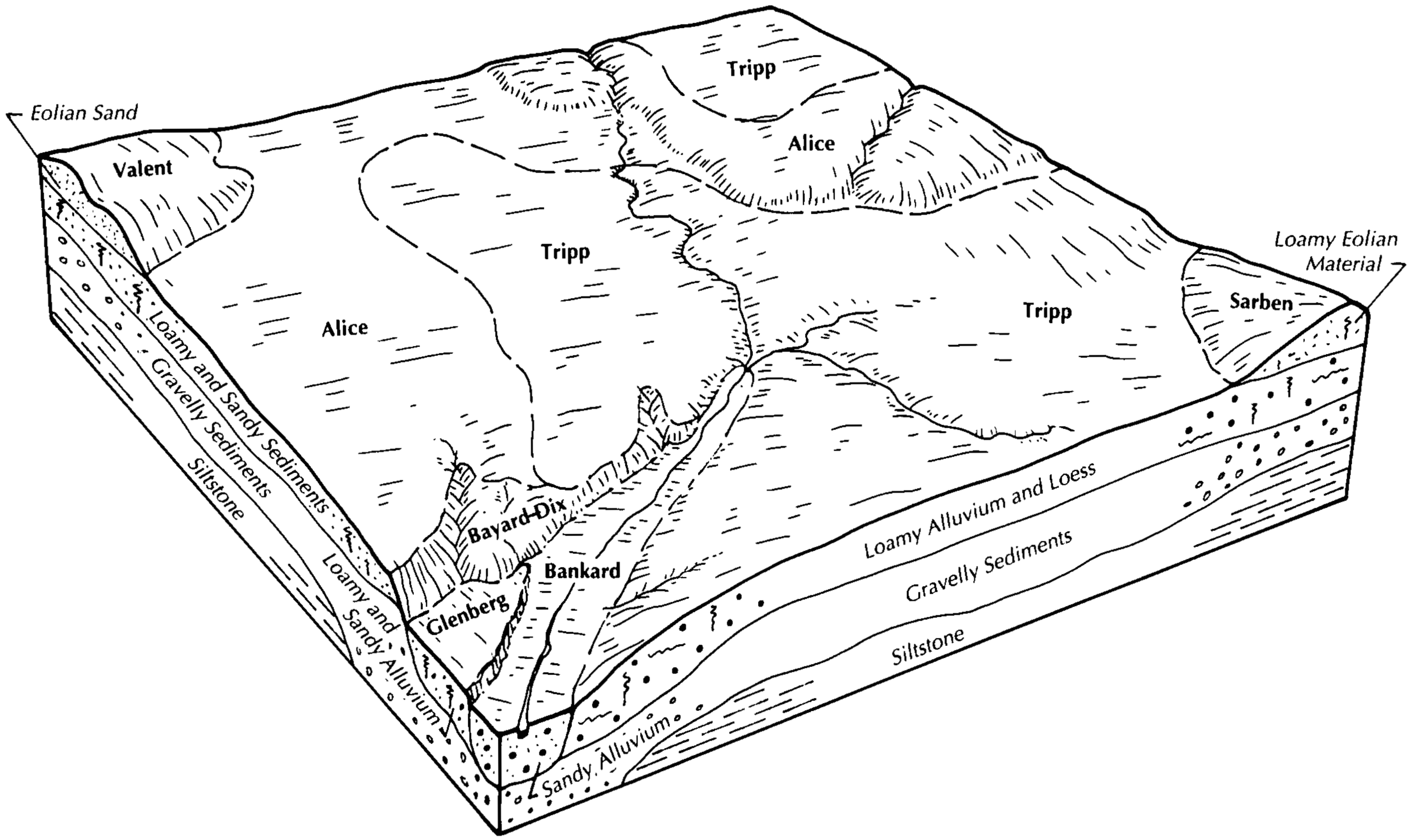

Figure 8.—Typical pattern of soils and parent material in the Tripp-Alice association.

light gray, calcareous very fine sandy loam.

Bayard soils are on foot slopes. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 4 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is light brownish gray in the upper part and pale brown in the lower part.

Of minor extent in this association are Valent and Epping soils. Valent and Epping soils are in landscape positions higher than those of the major soils. Valent soils are on dunes. They are excessively drained. Epping soils are on upland side slopes. They are shallow over siltstone bedrock.

The major soils in this association are used as cropland or range. Many of the cultivated areas are irrigated by sprinkler systems. The main irrigated crops are corn; dry, edible beans; and alfalfa. Wheat is the main dryland crop.

Soil blowing and water erosion are hazards in cultivated areas. Periods of low rainfall affect dryland crops. A system of conservation tillage that leaves crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Using irrigation water efficiently and maintaining fertility are management concerns. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to maintain or improve the range condition.

Nearly Level to Gently Sloping, Loamy and Sandy Soils on Alluvial Fans, Stream Terraces, and Bottom Land

These soils are deep, are nearly level to gently sloping, and are somewhat excessively drained, well drained, and somewhat poorly drained. Most of the soils are used for grazing. A small acreage is used for cultivated crops. Maintaining good range condition is the main management concern in areas of rangeland. Soil blowing, alkalinity, and flooding are the main management concerns in areas used for cultivated crops.

12. Janise-Yockey, Alkali-Lisco Association

Deep, nearly level, somewhat poorly drained, loamy soils; on bottom land

This association consists of soils on bottom land in the Pumpkin Creek valley. Slopes range from 0 to 2 percent.

This association has a total area of 7,400 acres, which is about 2 percent of the county. It is about 26 percent Janise soils, 24 percent alkali Yockey soils, 15 percent Lisco soils, and 35 percent minor soils.

Janise soils formed in loamy alluvium. Typically, the surface layer is light brownish gray, very friable, calcareous loam about 2 inches thick. The subsoil is light brownish gray, friable, calcareous loam about 16 inches thick. The underlying material extends to a depth of 60 inches or more. It is mottled, light gray, calcareous loam in the upper part and light gray, calcareous loamy very fine sand in the lower part.

The alkali Yockey soils formed in loamy and sandy alluvium. Typically, the surface layer is grayish brown, very friable, calcareous loam about 6 inches thick. Next is a transitional layer of pale brown, very friable, calcareous very fine sandy loam about 12 inches thick. The underlying material extends to a depth of 60 inches or more. It is light brownish gray, calcareous loam in the upper part and light gray, calcareous very fine sandy loam in the lower part.

Lisco soils formed in loamy alluvium. Typically, the surface layer is light brownish gray, very friable fine sandy loam about 6 inches thick. The subsoil is light brownish gray, very friable, calcareous fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is mottled, calcareous fine sandy loam. It is light gray in the upper part and very pale brown in the lower part.

Of minor extent in this association are Otero, Sarben, and Valent soils. Otero soils are on foot slopes, alluvial fans, and stream terraces. Valent and Sarben soils are on uplands.

The major soils in this association mainly support native grasses and are used as range or hayland. A few areas of these soils support introduced grasses that are used as pasture or are cut for hay. The soils are generally not well suited to cultivated crops because of the alkalinity or because they have a seasonal high water table.

A cover of range plants is effective in controlling soil blowing. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to maintain or improve the range condition.

13. Bankard-Bayard Association

Deep, nearly level to gently sloping, well drained and somewhat excessively drained, sandy and loamy soils; on alluvial fans, stream terraces, and bottom land

This association consists of soils in valleys along drainageways. Slopes range from 0 to 6 percent.

This association has a total area of 3,108 acres, which is about 1 percent of the county. It is about 48 percent Bankard soils, 30 percent Bayard soils, and 22 percent minor soils.

Bankard soils are somewhat excessively drained and are nearly level and very gently sloping. They formed in sandy alluvium on bottom land. Typically, the surface layer is brown, loose, calcareous loamy fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown sand that has thin strata of loam and very fine sandy loam.

Bayard soils are well drained and are nearly level to gently sloping. They formed in loamy and sandy sediments on alluvial fans and stream terraces. Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 4 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is light brownish gray in the upper part and pale brown in the lower part.

Of minor extent in this association are Bridget, Glenberg, Otero, and Vetal soils. Bridget soils have less sand than the major soils. They are on foot slopes, alluvial fans, and stream terraces. Glenberg soils have less sand than the Bankard soils. They are in landscape positions similar to those of the Bankard soils. Otero and Vetal soils are in landscape positions similar to those of the Bayard soils. Otero soils have a surface soil that is thinner than that of the Bayard soils, and Vetal soils have a surface soil that is thicker than that of the Bayard soils.

The major soils in this association mainly support native grasses and are used as range. A few small areas of these soils are used for irrigated crops or dryland crops. Irrigation is mainly provided by sprinkler systems. Corn, wheat, and alfalfa are the main crops.

Flooding is a hazard on the bottom land. Water erosion and soil blowing are hazards in cultivated areas. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to maintain or improve the range condition.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alliance loam, 3 to 6 percent slopes, is a phase of the Alliance series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Altvan-Eckley complex, 3 to 9 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The Rock outcrop part of the Tassel-Rock outcrop complex, 20 to 60 percent slopes, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

Soil Descriptions

AcB—Alice fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil formed in loamy and sandy sediments on stream terraces. Areas range from 5 to 300 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 7 inches thick. The subsurface layer also is grayish brown, very friable fine sandy loam. It is about 3 inches thick. The subsoil is about 20 inches thick. It is brown, very friable fine sandy loam in the upper part and light gray, very friable, calcareous fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is light gray, calcareous fine sandy loam. In some places the surface soil is more than 20 inches thick. In other places a buried silty layer is at a depth of 20 to 40 inches. In some areas the surface layer is lighter in color. In other areas it is loamy very fine sand, very fine sandy loam, or loam.

Included with this soil in mapping are small areas of Bayard, Dix, Sarben, Tripp, Valent, and Vetal soils.

Bayard soils are shallower to carbonates than the Alice soil. Also, they are lower on the landscape. Dix soils are shallow over sand and gravel. They are lower on the landscape than the Alice soils. Sarben soils do not have a dark surface layer and have more very fine sand in the upper part of the profile than the Alice soil. Also, they are higher on the landscape. Tripp soils have less sand throughout than the Alice soil. Also, they are lower on the landscape. Valent soils are sandy throughout. They are higher on the landscape than the Alice soil. Vetal soils are dark to a depth of 20 inches or more. They are lower on the landscape than the Alice soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Alice soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately high. Tilth is good.

Most of the acreage of this soil is farmed. Some areas are irrigated, but most are used for dryland farming.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface and cover crops help to control soil blowing and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing is a hazard. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the sandy underlying material in places. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the soil with cover crops or crop residue during the winter helps to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in a severe hazard of soil blowing. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated; Sandy range site; windbreak suitability group 5.

AcC—Alice fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loamy and sandy sediments on stream terraces. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 3 inches thick. The subsoil is about 17 inches thick. It is light brownish gray, very friable fine sandy loam in the upper part and light brownish gray, calcareous fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is pale brown, very friable, calcareous fine sandy loam. In some places, erosion has removed part of the original surface soil and tillage has mixed the remaining surface soil with the subsoil. In other places the surface layer is loamy very fine sand, very fine sandy loam, or loam. In some areas it is calcareous and is lighter in color. In other areas the surface soil is more than 20 inches thick. In some places the depth to carbonates is more than 38 inches. In other places a buried silty layer is at a depth of 20 to 40 inches.

Included with this soil in mapping are small areas of Bayard, Dix, Sarben, Tripp, Valent, and Vetal soils. Bayard soils are shallower to carbonates than the Alice soil. Also, they are lower on the landscape. Dix soils are shallow over sand and gravel. They are lower on the landscape than the Alice soil. Sarben soils do not have a dark surface layer and have more very fine sand in the upper part of the profile than the Alice soil. Also, they are higher on the landscape. Tripp soils have less sand throughout than the Alice soil. Also, they are lower

on the landscape. Valent soils are sandy throughout. They are higher on the landscape than the Alice soil. Vetal soils are dark to a depth of 20 inches or more. They are lower on the landscape than the Alice soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Alice soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately high. Tilth is good.

About half the acreage of this soil is used as range. The rest is used for dryland farming.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface and cover crops help to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control erosion and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the sandy underlying material in places. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the soil with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, needleandthread, blue grama, and threadleaf sedge. These species make up 60 percent or more of the total annual forage. Sand dropseed, prairie junegrass, western wheatgrass, sand bluestem, little bluestem, and other perennial grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are soil blowing, drought, and water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-3, dryland, and IIIe-8, irrigated; Sandy range site; windbreak suitability group 5.

AcD—Alice fine sandy loam, 6 to 9 percent slopes. This deep, strongly sloping, well drained soil formed in loamy and sandy sediments on stream terraces. Areas range from 5 to 80 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 9 inches thick. The subsoil is about 15 inches thick. It is pale brown, very friable fine sandy loam in the upper part and very pale brown, calcareous loamy very fine sand in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous loamy very fine sand. In some places, erosion has removed part of the original surface soil and tillage has mixed the remaining surface soil with the subsoil. In other places the surface layer is calcareous. In some areas it is loamy very fine sand, very fine sandy loam, or loam. In other areas a buried silty layer is at a depth of 20 to 40 inches. In places siltstone bedrock is within a depth of 40 inches.

Included with this soil in mapping are small areas of Bayard, Dix, Sarben, Tripp, Valent, and Vetal soils. Bayard soils are shallower to carbonates than the Alice

soil. Also, they are lower on the landscape. Dix soils are shallow over sand and gravel. They are lower on the landscape than the Alice soil. Sarben soils do not have a dark surface layer and have more very fine sand in the upper part of the profile than the Alice soil. Also, they are higher on the landscape. Tripp soils have less sand throughout than the Alice soil. Also, they are lower on the landscape. Valent soils are sandy throughout. They are higher on the landscape than the Alice soil. Vetal soils are dark to a depth of 20 inches or more. They are lower on the landscape than the Alice soil. Included soils make up 5 to 10 percent of the unit.

Most of the acreage of this soil is used as range. Some areas are used for dryland farming.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are hazards. Carefully managing irrigation water and applying a system of conservation tillage that keeps crop residue on the surface help to control erosion.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, needleandthread, blue grama, and threadleaf sedge. These species make up 60 percent or more of the total annual forage. Sand dropseed, prairie junegrass, western wheatgrass, sand bluestem, little bluestem, other perennial grasses and forbs, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are soil blowing, drought, and water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-3, dryland, and IVe-8, irrigated; Sandy range site; windbreak suitability group 5.

Ae—Alliance loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in loess and in material weathered from calcareous sandstone bedrock. It is on uplands. Areas range from 10 to 300 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 8 inches thick. The subsoil is about 18 inches thick. It is brown and pale brown, friable clay loam in the upper part and pale brown, calcareous loam in the lower part. The underlying material to a depth of 44 inches is very pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 44 inches. In some places the calcareous sandstone bedrock is at a depth of more than 60 inches. In other places the subsoil has less clay and more fine sand. In some areas the dark surface soil is more than 20 inches thick. In other areas the lower part of the underlying material is strongly alkaline.

Included with this soil in mapping are small areas of Altvan, Duroc, Rosebud, and Sidney soils. Altvan soils are moderately deep over sand and gravel. They are on convex knobs and side slopes. Duroc soils have a surface soil that is more than 20 inches thick. They are in upland swales. Rosebud and Sidney soils have calcareous sandstone bedrock at a depth of 40 to 60 inches. Rosebud soils are lower on the landscape than the Alliance soil. Sidney soils have less clay in the subsoil than the Alliance soil. They are on the steeper

slopes. Included soils make up 10 to 20 percent of the unit.

Permeability is moderate in the Alliance soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately low. Tilth is good.

Nearly all of the acreage of this soil is used for dryland farming. A few small areas are irrigated.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. The lack of precipitation is a major limitation. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface and cover crops help to control soil blowing and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the underlying sandstone bedrock in some places. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil is suited to dwellings with basements and small commercial buildings. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIc-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 3.

AeB—Alliance loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loess and in material weathered from calcareous sandstone bedrock. It is on side slopes in the uplands. Areas range from 10 to 600 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 8 inches thick. The subsoil is about 19 inches thick. It is grayish brown and brown, friable clay loam in the upper part; brown, very friable loam in the next part; and pale brown, calcareous loam in the lower part. The underlying material extends to a depth of 44 inches. It is very pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 44 inches. In some places the depth to sandstone bedrock is more than 60 inches. In other places it is less than 40 inches. In some areas the subsoil has less clay and more fine sand. In other areas the underlying material is strongly alkaline. In places carbonates have accumulated in the lower part of the subsoil.

Included with this soil in mapping are small areas of Altvan, Canyon, and Sidney soils. Altvan soils are moderately deep over sand and gravel. They are on convex knobs and side slopes. The shallow Canyon soils are on convex upper side slopes and ridgetops. Sidney soils have calcareous sandstone bedrock at a depth of 40 to 60 inches. They have less clay in the subsoil than the Alliance soil. They are on the steeper slopes. Included soils make up 10 to 20 percent of the unit.

Permeability is moderate in the Alliance soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately low. Tilth is good.

Nearly all of the acreage of this soil is used for dryland farming. A few small areas are irrigated.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the

runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the underlying sandstone bedrock in some places. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs planted as windbreaks. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil is suited to dwellings with basements and small commercial buildings. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 3.

AeC—Alliance loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loess and in material weathered from calcareous sandstone bedrock. It is on convex ridgetops and side slopes in the uplands. Areas range from 5 to 640 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 5 inches thick. The subsurface layer also is grayish brown, very friable loam. It is about 3 inches thick. The subsoil is about 18 inches thick. It is light brownish gray, very friable clay loam in the upper part; pale brown, friable clay loam in the next part; and pale brown, very friable loam in the lower part. The underlying material extends to a depth of 54 inches. It is white and very pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 54 inches. In some areas, erosion has removed all or part of the original surface soil and tillage has mixed the remaining surface soil with the subsoil. In other areas the depth to sandstone bedrock is more than 60 inches. In some places it is less than 40 inches. In other places the underlying material is strongly alkaline. In some areas the surface layer is lighter in color. In other areas the surface layer and subsoil are very fine sandy loam.

Included with this soil in mapping are small areas of Altvan, Canyon, and Sidney soils. Altvan soils are moderately deep over sand and gravel. They are on knolls and side slopes. The shallow Canyon soils are on convex upper side slopes and ridgetops. Sidney soils have calcareous sandstone bedrock at a depth of 40 to 60 inches. They have less clay in the subsoil than the Alliance soil. They are on the steeper slopes. Included soils make up 10 to 20 percent of the unit.

Permeability is moderate in the Alliance soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderately low. Tilth is good.

Most of the acreage of this soil is used for dryland farming. A few small areas are irrigated. The remaining acreage is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are hazards. A system of conservation tillage, such as chiseling or disking, that helps keep crop residue on the surface helps to control erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the soil with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying

barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, soil blowing, and water erosion are the main hazards. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation between the tree rows with conventional equipment and by timely applications of the appropriate herbicide.

This soil is suited to dwellings with basements and small commercial buildings. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; windbreak suitability group 3.

AeD2—Alliance loam, 6 to 9 percent slopes, eroded. This deep, strongly sloping, well drained soil formed in loess and in material weathered from calcareous sandstone bedrock. It is on side slopes in the uplands. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 4 inches thick. The subsoil is about 20 inches thick. It is pale brown loam in the upper part; pale brown clay loam in the next part; and very pale brown, calcareous loam in the lower part. The underlying material extends to a depth of 42 inches. It is very pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 42 inches. In some places the surface layer is thicker. In other places it is clay loam, very fine sandy loam, or fine sandy loam. In some areas the subsoil has more fine sand. In other areas, erosion has removed some or all of the original surface soil and tillage has mixed the remaining surface soil with the subsoil.

Included with this soil in mapping are small areas of Altvan, Canyon, Duroc, and Sidney soils. Altvan soils are moderately deep over sand and gravel. They are on convex knobs and side slopes. The shallow Canyon soils are on convex side slopes and shoulders of ridgetops. Duroc and Sidney soils have less clay than the Alliance soil. Duroc soils are in drainageways. They are dark to a depth of 20 inches or more. Sidney soils have calcareous sandstone bedrock at a depth of 40 to 60 inches. They are on side slopes and foot slopes. Included areas make up 10 to 20 percent of this unit.

Permeability is moderate in the Alliance soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate also is moderately low. Tilth is good.

Most of the acreage of this soil is used for dryland farming. A few small areas are irrigated. The remaining acreage is used as range.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks. Water erosion, soil blowing, and drought are the main hazards. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during dry periods. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil is suited to dwellings with basements and small commercial buildings. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-8, dryland, and IVe-4, irrigated; Silty range site; windbreak suitability group 3.

AgC—Altvan loam, 3 to 6 percent slopes. This gently sloping, well drained soil is moderately deep over gravelly coarse sand. It formed in loamy sediments on side slopes and ridges in the uplands. Areas range from 15 to 80 acres in size.

Typically, the surface layer is brown, very friable loam about 8 inches thick. The subsoil is about 17 inches thick. It is brown and pale brown, friable clay loam in the upper part and very pale brown, very friable loam in the lower part. The underlying material extends to a depth of 29 inches. It is pale brown, calcareous loam. Pale brown gravelly coarse sand is at a depth of 27 inches. In places the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Canyon, Rosebud, and Satanta soils. Canyon soils have calcareous sandstone bedrock at a depth of 6 to 20 inches. They are higher on the landscape than the Altvan soil. Rosebud and Satanta soils are in landscape positions similar to those of the Altvan soil. Rosebud soils have sandstone bedrock at a depth of 20 to 40 inches. Satanta soils are deep. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the solum of the Altvan soil and very rapid in the underlying material. The available water capacity is moderate. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate.

Most of the acreage of this soil is used for dryland farming. A few small areas are used as range.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. If land grading is needed when an irrigation system is installed or terraces are constructed, deep cuts may expose the gravelly underlying material. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, soil blowing, and water erosion are the main hazards. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings and small commercial buildings. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are shored. The

damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-1, dryland, and IVe-7, irrigated; Silty range site; windbreak suitability group 6G.

AhD—Altvan-Eckley complex, 3 to 9 percent slopes. These well drained, gently sloping and strongly sloping soils are on uplands. The Altvan soil is moderately deep over gravelly coarse sand. It is on convex summits and side slopes. It formed in loamy sediments. The Eckley soil is shallow over very gravelly sand. It is on the convex upper side slopes and ridgetops. Areas range from 10 to 200 acres in size. They are 50 to 70 percent Altvan soil and 20 to 40 percent Eckley soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Altvan soil has a surface layer of grayish brown, very friable loam about 7 inches thick. The subsoil is about 14 inches thick. It is brown, friable clay loam in the upper part and pale brown, very friable, calcareous loam in the lower part. The underlying material extends to a depth of 30 inches. It is very pale brown, calcareous loam. Reddish yellow gravelly coarse sand is at a depth of 27 inches. In some places the subsoil has less clay. In other places the depth to gravelly coarse sand is more than 40 inches. In some areas calcareous sandstone bedrock is at a depth of 20 to 40 inches.

Typically, the Eckley soil has a surface layer of grayish brown, very friable gravelly sandy loam about 7 inches thick. The subsoil is grayish brown, very friable gravelly sandy clay loam about 4 inches thick. The underlying material extends to a depth of 17 inches. It is light brownish gray gravelly loamy sand. Very pale brown very gravelly sand is at a depth of 34 inches. In some cultivated areas, erosion has removed all or most of the original surface soil and tillage has exposed the underlying material at the surface. In these areas the surface layer is lighter in color. In places it is gravelly sandy clay loam.

Included with these soils in mapping are small areas of Alliance and Canyon soils and small outcrops of gravel and bedrock. Alliance soils are deep over sandstone bedrock. They are on ridgetops. Canyon soils are shallow. They are in landscape positions similar to those of the Eckley soil. The small outcrops of gravel and bedrock are on the steeper upper side slopes and narrow ridgetops. Included areas make up 10 to 20 percent of the unit.

Permeability is moderate in the solum of the Altvan and Eckley soils and very rapid in the underlying material. The available water capacity is moderate in the Altvan soil and low in the Eckley soil. Runoff is medium on both soils. The organic matter content is moderately low in the Altvan soil and moderate in the Eckley soil. The water intake rate is moderate in both soils. Tilth is good in the Altvan soil.

Most of the acreage of these soils is dryland farmed. A few small areas are irrigated. The remaining acreage supports native grasses and is used as range.

If dry-farmed, these soils are poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, these soils are poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

The Altvan soil is suited to the trees and shrubs grown as windbreaks. Drought, soil blowing, and water erosion are the main hazards. The Eckley soil is unsuited to the trees and shrubs grown as windbreaks because of the low available water capacity and the shallow root zone. Onsite investigation is needed to

select suitable sites for planting trees in areas of these soils. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing help to control runoff and water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

These soils are generally suited to dwellings and small commercial buildings. They readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are shored. The damage to roads caused by frost action in areas of the Altvan soil can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage. The Eckley soil generally is suited to roads and streets.

The land capability units are IVe-1, dryland, and IVe-7, irrigated. The Altvan soil is in the Silty range site and windbreak suitability group 6G. The Eckley soil is in the Shallow to Gravel range site and windbreak suitability group 10.

Bb—Bankard loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, somewhat excessively drained soil formed in stratified, sandy alluvium. It is on bottom land and is occasionally flooded. Areas range from 5 to 50 acres in size.

Typically, the surface layer is brown, loose, calcareous loamy fine sand about 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown sand that has thin strata of loam and very fine sandy loam. In some areas the surface layer is sand, fine sand, loamy very fine sand, or very fine sandy loam.

Included with this soil in mapping are small areas of Bayard, Glenberg, and Otero soils. These soils have more silt and less sand than the Bankard soil. Also, they are higher on the landscape. Bayard soils have a dark surface soil that is more than 10 inches thick. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Bankard soil, and the available water capacity is low. Runoff is slow. The organic matter content is low. The water intake rate is very high.

Most of the acreage of this soil supports native grasses and is used as range. A few small areas are used as cropland.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. The main hazard is flooding following periods of heavy rainfall. The flooding, however, is very brief and seldom causes severe crop damage. Constructing diversion terraces and dikes helps to control flooding in some areas. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as disking and chiseling, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil and applying barnyard manure increase the content of organic matter, improve fertility, and help to maintain tilth.

If irrigated, this soil is poorly suited to corn and alfalfa. The main hazard is the flooding following periods of heavy rainfall. The flooding, however, is of short duration and seldom causes severe damage. Constructing diversion terraces and dikes helps to control flooding in some areas. Carefully managing applications of water can prevent the leaching of plant nutrients and pesticides below the plant roots. Returning crop residue to the soil and minimizing tillage help to control soil blowing and maintain fertility. Protecting the soil with cover crops or crop residue during the winter helps to control soil blowing.

In the areas used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, and little bluestem. These species make up 70 percent or more of the total annual forage. Needleandthread, blue grama, switchgrass, sand dropseed, Scribner panicum, and other perennial grasses make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and forbs dominate the site. As a result, the native plants lose vigor and are unable to stabilize the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and soil blowing. The species selected for planting should be those that are moderately tolerant of drought and that

can be grown in areas of sandy soils. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Because the consistence of the soil is loose, trees should be planted in shallow furrows with as little disturbance of the soil as possible. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil is not suited to sanitary facilities and dwellings because of the flooding and a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. A suitable alternative site should be selected. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding.

The land capability units are IVw-5, dryland, and IVw-11, irrigated; Sandy Lowland range site; windbreak suitability group 7.

Bc—Bankard fine sand, channeled. This deep, nearly level, somewhat excessively drained soil formed in stratified, sandy alluvium. It is on bottom land that is dissected by meandering stream channels. It is frequently flooded for brief periods. Areas range from 5 to 300 acres in size. Slopes are mainly 0 to 3 percent.

Typically, the surface layer is pale brown, loose, calcareous fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand that has thin strata of loamy very fine sand and very fine sandy loam. In places the surface layer is very coarse sand, coarse sand, sand, or loamy fine sand.

Included with this soil in mapping are small areas of Glenberg and Valent soils. Glenberg soils are well drained and have less sand and more silt than the Bankard soil. Also, they are higher on the landscape. Valent soils are not stratified and are on dunes. Included soils make up less than 10 percent of the unit.

Permeability is rapid in the Bankard soil, and the available water capacity is low. Runoff is slow. The organic matter content is low.

Nearly all of the acreage of this soil supports native grasses and is used for grazing. The soil is not suitable as cropland or range because of the flooding. Because of the hazards of drought and flooding, plant communities vary widely and range management is difficult. The soil generally is not suited to the trees and shrubs grown as windbreaks because it is too droughty and is frequently flooded.

This soil generally is not suited to sanitary facilities and buildings because of the flooding. A suitable alternative site should be selected. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding.

The land capability units are VIw-7, dryland; windbreak suitability group 10. No range site is assigned.

BdB—Bayard very fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loamy and sandy sediments on alluvial fans, foot slopes, and stream terraces. Areas range from 15 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 4 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is light brownish gray in the upper part and pale brown in the lower part. In some places the surface layer is loamy very fine sand, fine sandy loam, or loam. In other places carbonates are leached below a depth of 20 inches. In some areas the surface soil is dark to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Bridget and Otero soils. Bridget soils have less fine sand and more silt than the Bayard soil. They are in landscape positions similar to those of the Bayard soil. Otero soils have a surface layer that is lighter in color than that of the Bayard soil. They have carbonates at the surface. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately high. Tilth is good.

Most of the acreage of this soil is used as cropland. A few small areas support native grasses and are used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves

fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing is the main hazard. Applying a system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the sandy underlying material in places. Returning crop residue to the soil and minimizing tillage help to control soil blowing and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide supplemental moisture needed during periods of low rainfall. Weeds and grasses can be controlled by cultivation with conventional equipment and by applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated; Sandy range site; windbreak suitability group 5.

BdC—Bayard very fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loamy and sandy sediments on alluvial fans, foot slopes, and stream terraces. Areas range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, very friable very fine sandy loam about 12 inches thick. The subsurface layer is dark grayish brown, very friable, calcareous very fine sandy loam about 6 inches thick. Next is a transitional layer of grayish brown, very friable, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is pale brown in the upper part and light yellowish brown in the lower part. In some places the surface layer is loamy very fine sand, fine sandy loam, or loam. In other places it is lighter in color. In some areas the surface soil is dark to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Bridget and Otero soils. These soils are in landscape positions similar to those of the Bayard soil. Bridget soils have more silt and less fine sand than the Bayard soil. Otero soils have a surface layer that is lighter in color than that of the Bayard soil. They are calcareous at the surface. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderately high. Tilth is good.

Most of the acreage of this soil supports native grasses and is used for grazing. The rest is used as cropland.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the sandy underlying material in places. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

In the areas used as range or hayland, the climax vegetation is dominantly prairie sandreed, blue grama, needleandthread, sand bluestem, and little bluestem.

These species make up 70 percent or more of the total annual forage. Indian ricegrass, threadleaf sedge, little bluestem, and perennial grasses make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only every other year. During the year the forage is not harvested, the hayland should be used only as fall or winter range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Weeds and grasses can be controlled by cultivation with conventional equipment and by applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-3, dryland, and IIIe-8, irrigated; Sandy range site; windbreak suitability group 5.

BdD—Bayard very fine sandy loam, 6 to 9 percent slopes. This deep, strongly sloping, well drained soil formed in loamy and sandy sediments on alluvial fans, foot slopes, and stream terraces. Areas range from 5 to 140 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous very fine sandy loam about 6 inches thick. The subsurface layer also is grayish brown, very friable, calcareous very fine sandy loam. It is about 4 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is light brownish gray in the upper part and pale brown in the lower part. In some places the surface layer is loamy very fine sand, fine sandy loam, or loam. In other places it is lighter in color. In some areas the surface soil is dark to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Bridget and Otero soils. These soils are in landscape positions similar to those of the Bayard soil. Bridget soils have less fine sand and more silt than the Bayard soil. Otero soils have a surface layer that is lighter in color than that of the Bayard soil. They have carbonates at the surface. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderately high. Tilth is good.

Most of the acreage of this soil supports native grasses and is used for grazing. The rest is used as cropland.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, blue grama, needleandthread, sand bluestem, and little bluestem. These species make up 70 percent or more of the total annual forage. Indian ricegrass, threadleaf sedge, little bluestem, perennial grasses, and sedges make up the rest. If subject to continuous heavy grazing, sand

bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Planting the trees on the contour and terracing help to reduce the runoff rate and control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The sides of shallow excavations can cave in unless they are shored. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-3, dryland, and IVe-8, irrigated; Sandy range site; windbreak suitability group 5.

BdE—Bayard very fine sandy loam, 9 to 20 percent slopes. This deep, moderately steep, well drained soil formed in loamy and sandy sediments on alluvial fans, foot slopes, and stream terraces. Areas range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable, calcareous very fine sandy loam about 7 inches thick. The subsurface layer also is dark grayish brown, very friable, calcareous very fine sandy loam. It is about 10 inches thick. Next is a transitional layer of grayish brown, very friable, calcareous loamy very fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is grayish brown, calcareous loamy very fine sand. In places the surface soil is dark to a depth of 20 inches or more.

Included with this soil in mapping are small areas of Mitchell and Otero soils. These soils have a surface layer that is lighter in color than that of the Bayard soil. They are in landscape positions similar to those of the Bayard soil. They have carbonates at the surface. Mitchell soils have less fine sand than the Bayard soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Bayard soil, and the available water capacity is moderate. Runoff is rapid. The organic matter content is moderate.

Nearly all of the acreage of this soil supports native grasses and is used as range. The soil generally is not suited to cropland because of the slope, soil blowing, and water erosion.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, blue grama, needleandthread, sand bluestem, and little bluestem. These species make up 70 percent or more of the total annual forage. Indian ricegrass, threadleaf sedge, little bluestem, perennial grasses, and sedges make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation is needed during dry periods. Planting the trees on the contour and terracing help to reduce the runoff rate and control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is not suited to sanitary facilities because of the slope. A suitable alternative site should be selected. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The sides of shallow excavations can cave in unless they are shored. Cutting and filling can provide a suitable grade for roads. The damage to roads caused by frost action

can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is VIe-3, dryland; Sandy range site; windbreak suitability group 7.

BeD—Bayard-Dix complex, 3 to 9 percent slopes. These soils are gently sloping and strongly sloping. The Bayard soil is deep and well drained and is on the lower part of concave side slopes of valleys, fans, and stream terraces. It formed in loamy and sandy sediments. The Dix soil is excessively drained. It is shallow to gravelly coarse sand and is on the breaks to stream terraces, on alluvial fans, and on foot slopes. It formed in gravelly sediments. Areas range from 5 to 300 acres in size. They are 35 to 65 percent Bayard soil and 15 to 45 percent Dix soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Bayard soil has a surface layer of grayish brown, very friable fine sandy loam about 7 inches thick. The subsurface layer also is grayish brown, very friable fine sandy loam. It is about 5 inches thick. Next is a transitional layer of brown, very friable fine sandy loam about 6 inches thick. The underlying material extends to a depth of 60 inches or more. It is pale brown, calcareous fine sandy loam in the upper part and very pale brown, calcareous loamy very fine sand in the lower part. In some places the depth to carbonates is more than 20 inches. In other places the dark surface soil is more than 20 inches thick. In some areas the underlying material is loamy fine sand.

Typically, the Dix soil has a surface layer of grayish brown, very friable gravelly loam about 7 inches thick. Next is a transitional layer of brown, very friable gravelly loam about 7 inches thick. Pale brown gravelly coarse sand extends to a depth of 60 inches or more. In some places the surface layer is lighter in color.

Included with these soils in mapping are small areas of Epping, Otero, Tripp, and Valent soils and outcrops of siltstone bedrock. Epping soils are shallow over siltstone bedrock. They are lower on the landscape than the Bayard and Dix soils. Otero soils have a surface layer that is lighter in color than that of the Bayard and Dix soils. They have carbonates at the surface. They are in landscape positions similar to those of the Bayard and Dix soils. Tripp soils have less sand throughout than the Bayard and Dix soils. Also, they are generally higher on the landscape. Valent soils are sandy and are on dunes. The outcrops of siltstone bedrock are on sharp slope breaks. Included areas make up 20 to 25 percent of the unit.

Permeability is moderately rapid in the Bayard soil and rapid or very rapid in the Dix soil. The available water capacity is moderate in the Bayard soil and very low in the Dix soil. Runoff is medium on both soils. The organic matter content is moderate in the Bayard soil and moderately low in the Dix soil. The water intake rate is moderately high in both soils.

About half the acreage of these soils is used as cropland. The rest supports native grasses and is used for grazing. Some of the cropland is irrigated.

If dry-farmed, these soils are poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, these soils are poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soils. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

If these soils are used as range, the climax vegetation in areas of the Bayard soil is dominantly prairie sandreed, blue grama, needleandthread, and sand bluestem. These species make up 70 percent or more of the total annual forage on this soil. Indian ricegrass, threadleaf sedge, little bluestem, and sedges make up the rest. The climax vegetation in areas of the Dix soil is blue grama, sand dropseed, Fendler threeawn, and needleandthread. These species make up 55 percent or more of the total annual forage on this soil. Sand bluestem, little bluestem, hairy grama, sedges, and forbs make up the rest. If the Bayard soil is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, buffalograss, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive. If the Dix soil is subject to continuous heavy grazing, sand bluestem, little

bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, common pricklypear, brittle pricklypear, fringed sagewort, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre on the Bayard soil and 0.3 animal unit month per acre on the Dix soil. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to keep little bluestem and prairie sandreed in the plant community. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The very low available water capacity and droughtiness are limitations in areas of the Dix soil. The amount of forage produced depends on the frequency and amount of seasonal rainfall.

The Bayard soil is suited to the trees and shrubs grown as windbreaks. The Dix soil is not suited to the trees and shrubs grown as windbreaks because of the very low available water capacity and the shallow rooting depth. Onsite investigation is needed when planning a windbreak that will be planted in areas of these soils. Soil blowing, drought, and water erosion are the main hazards in areas of the Bayard soil. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Bayard soil generally is suited to septic tank absorption fields and dwellings. The Dix soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. A suitable alternative site should be selected. The sides of shallow excavations in areas of the Bayard soil can cave in unless they are shored. Cutting and filling can provide a suitable grade for roads. The damage to roads by frost action in areas of the Bayard soil can be reduced by providing good surface drainage and by using a moisture barrier of gravel in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-3 dryland, and IVe-8, irrigated. The Bayard soil is in the Sandy range site and windbreak suitability group 5. The Dix soil is in the Shallow to Gravel range site and windbreak suitability group 10.

BeE—Bayard-Dix complex, 9 to 20 percent slopes. These soils are moderately steep. The Bayard soil is deep and well drained and is on the lower part of side slopes, alluvial fans, and stream terraces. It formed in loamy and sandy sediments. The Dix soil is excessively drained. It is shallow to gravelly coarse sand and is on the breaks to stream terraces, on alluvial fans, and on foot slopes. It formed in gravelly sediments. Areas range from 5 to 300 acres in size. They are 30 to 70 percent Bayard soil and 10 to 50 percent Dix soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Bayard soil has a surface layer of grayish brown, very friable fine sandy loam about 8 inches thick. The subsurface layer also is grayish brown, very friable fine sandy loam. It is about 4 inches thick. Next is a transitional layer of pale brown, very friable fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is white, calcareous fine sandy loam. In some places the depth to carbonates is more than 20 inches. In other places the surface soil is dark to a depth of more than 20 inches. In some areas the underlying material is loamy fine sand.

Typically, the Dix soil has a surface layer of dark grayish brown, very friable gravelly loam about 7 inches thick. Next is a transitional layer of brown, very friable gravelly loam about 8 inches thick. Pale brown very gravelly coarse sand extends to a depth of 60 inches or more. In places the surface layer is lighter in color.

Included with these soils in mapping are small areas of Alice, Epping, Otero, Tripp, and Valent soils and outcrops of siltstone and gravel. Alice and Tripp soils have an accumulation of carbonates in the lower part of the subsoil. They are generally higher on the landscape than the Bayard and Dix soils. Epping soils are shallow over siltstone bedrock. They are in landscape positions similar to those of the Bayard and Dix soils. Valent soils are sandy. They are on dunes. The outcrops of siltstone and gravel are common on the steeper slopes. Included areas make up 20 to 25 percent of the unit.

Permeability is moderately rapid in the Bayard soil and rapid or very rapid in the Dix soil. The available water capacity is moderate in the Bayard soil and very low in the Dix soil. Runoff is rapid on both soils. The organic matter content is moderate in the Bayard soil and moderately low in the Dix soil.

Nearly all of the acreage of these soils supports

native grasses and is used for grazing. A few of the less sloping areas are cultivated. The soils are not suited to farming because of the slope and the hazards of soil blowing and water erosion.

If these soils are used as range, the climax vegetation in areas of the Bayard soil is dominantly prairie sandreed, blue grama, needleandthread, and sand bluestem. These species make up 70 percent or more of the total annual forage on this soil. Indian ricegrass, threadleaf sedge, little bluestem, and sedges make up the rest. The climax vegetation in areas of the Dix soil is blue grama, sand dropseed, Fendler threeawn, and needleandthread. These species make up 55 percent or more of the total annual forage on this soil. Sand bluestem, little bluestem, hairy grama, sedges, and forbs make up the rest. If the Bayard soil is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, buffalograss, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive. If the Dix soil is subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, common pricklypear, brittle pricklypear, fringed sagewort, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre on the Bayard soil and 0.3 animal unit month per acre on the Dix soil. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to keep little bluestem and prairie sandreed in the plant community. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The very low available water capacity and droughtiness are limitations in areas of the Dix soil. The amount of forage produced depends on the frequency and amount of seasonal rainfall. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

The Bayard soil is suited to the trees and shrubs grown as windbreaks. The Dix soil is not suited to the trees and shrubs grown as windbreaks because of the very low available water capacity and the shallow rooting depth. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing help to reduce the runoff rate and control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

In areas of the Bayard soil, land shaping and installing septic tank absorption fields on the contour help to ensure that the fields function properly. The Dix soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. A suitable alternative site should be selected. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The sides of shallow excavations can cave in unless they are shored. Cutting and filling can provide a suitable grade for roads. The damage to roads caused by frost action in areas of the Bayard soil can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is VIe-3, dryland. The Bayard soil is in the Sandy range site and windbreak suitability group 7. The Dix soil is in the Shallow to Gravel range site and windbreak suitability group 10.

Bg—Bridget very fine sandy loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in loamy sediments on stream terraces, foot slopes, and alluvial fans. It is subject to rare flooding. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 10 inches thick. Next is a transitional layer of light brownish gray, very friable, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is light brownish gray in the upper part and light gray in the lower part. In some places the surface soil is loam. In other places it is more than 20 inches thick. In some areas the carbonates are below a depth of 15 inches.

Included with this soil in mapping are small areas of Bayard, Mitchell, and Otero soils. Bayard soils have more sand than the Bridget soil. Mitchell and Otero soils have a lighter colored surface layer than that of the Bridget soil. They are in landscape positions similar

Figure 9.—Wheat being harvested in an area of Bridget very fine sandy loam, 0 to 1 percent slopes.

to those of the Bridget soil. Otero soils have more sand and less silt than the Bridget soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Bridget soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

Nearly all of the acreage of this soil is used as cropland. The rest supports native grasses and is used for range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers (fig. 9). Drought is a major hazard. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing is a hazard. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the sandy underlying material in places. Returning crop residue to the soil and minimizing tillage help to control soil blowing and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil

blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The flooding is a hazard on sites for a septic tank absorption fields. Constructing dwellings on raised, well compacted fill material helps to prevent the damage to dwellings caused by flooding. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIc-1, dryland, and IIe-6, irrigated; Silty range site; windbreak suitability group 3.

BgB—Bridget very fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loamy sediments on stream terraces, foot slopes, and alluvial fans. It is subject to rare flooding. Areas range from 5 to 150 acres in size.

Typically, the surface layer is brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer is grayish brown, very friable very fine sandy loam about 7 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is pale brown in the upper part and very pale brown in the lower part. In some places the surface soil is more than 20 inches thick. In other places the surface layer is fine sandy loam or loam. In a few areas carbonates are at a depth of more than 15 inches.

Included with this soil in mapping are small areas of Bayard, Mitchell, and Vetal soils. Bayard and Mitchell soils are in landscape positions similar to those of the Bridget soil. Bayard soils have more fine sand and less silt than the Bridget soil. Mitchell soils have a surface layer that is lighter in color than that of the Bridget soil. They have carbonates at the surface. Vetal soils have a dark surface soil that is more than 20 inches thick. They have more fine sand than the Bridget soil. Also, they are lower on the landscape. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Bridget soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

More than half of the acreage of this soil is used as cropland. The rest is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The flooding is a hazard on sites for septic tank absorption fields. Constructing dwellings on raised, well compacted fill material helps to prevent the damage to dwellings caused by flooding. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and

constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-6, irrigated; Silty range site; windbreak suitability group 3.

BgC—Bridget very fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loamy sediments on stream terraces, foot slopes, and alluvial fans. Areas range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The subsurface layer is brown, very friable, calcareous very fine sandy loam about 7 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of 60 inches or more is pale brown, calcareous very fine sandy loam. In some places the surface soil is more than 20 inches thick. In other places it has more sand. In a few areas the surface layer is lighter in color.

Included with this soil in mapping are small areas of Bayard, Epping, and Mitchell soils and a few areas of soil where the slope is more than 6 percent. Bayard soils have more fine sand than the Bridget soil. They are in landscape positions similar to those of the Bridget soil. Mitchell soils do not have a dark surface soil. They are higher on the landscape than the Bridget soil. Epping soils are less than 20 inches deep over siltstone bedrock. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Bridget soil, and the available water capacity is high. Runoff is medium. Organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

About half the acreage of this soil is used as cropland. The rest is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation is best suited to the soil. Soil blowing and water erosion are the main hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, water erosion, and soil blowing are the main hazards. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIIe-6, irrigated; Silty range site; windbreak suitability group 3.

BgD—Bridget very fine sandy loam, 6 to 9 percent slopes. This deep, strongly sloping, well drained soil formed in loamy sediments on stream terraces, foot slopes, and alluvial fans. Areas range from 10 to 40 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 9 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 3 inches thick. Next is a transitional layer of light brownish gray, very friable, calcareous very fine sandy loam about 4 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is light brownish gray in the upper part and pale brown in the lower part. In some places the surface soil is more than 20 inches thick. In other places the soil has more fine sand throughout.

Included with this soil in mapping are small areas of Bayard, Epping, and Mitchell soils and areas of soil

where the slope is more than 9 percent. Bayard soils have more fine sand than the Bridget soil. They are in landscape positions similar to those of the Bridget soil. Mitchell and Epping soils are higher on the landscape than the Bridget soil. Mitchell soils do not have a dark surface soil. Epping soils are shallow over siltstone bedrock. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Bridget soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

Most of the acreage of this soil supports native grasses and is used as range. A few small areas are farmed.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control water erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation is best suited to the soil. Soil blowing and water erosion are hazards. A conservation tillage system that keeps crop residue on the surface helps to control soil blowing and water erosion. Returning crop residue to the soil and minimizing tillage help to control soil blowing and water erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion.

In the areas used as range, the climax vegetation is dominantly blue grama, western wheatgrass, needleandthread, threadleaf sedge, and buffalograss. These species make up 75 percent or more of the total annual forage. Little bluestem, sideoats grama, plains muhly, prairie junegrass, green needlegrass, sand dropseed, Sandberg bluegrass, and sedges make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, and prairie junegrass decrease in abundance and are replaced by blue grama, buffalograss, needleandthread, plains muhly, sand dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, water erosion, and soil blowing are the main hazards. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. Buildings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-3, dryland, and IVe-6, irrigated; Silty range site; windbreak suitability group 3.

BgE—Bridget very fine sandy loam, 9 to 20 percent slopes. This deep, moderately steep, well drained soil formed in loamy sediments on stream terraces and foot slopes. Areas range from 10 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 4 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 6 inches thick. Next is a transitional layer of grayish brown, very friable, calcareous very fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches or more is calcareous very fine sandy loam. It is pale brown in the upper part and light brownish gray in the lower part. In some places the surface soil is more than 20 inches thick. In other places the soil has more fine sand.

Included with this soil in mapping are small areas of Mitchell and Otero soils. These soils do not have a dark surface layer. Otero soils have more fine sand than the Bridget soil. The included soils are higher on the landscape than the Bridget soil. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Bridget soil, and the available water capacity is high. Runoff is rapid. The organic matter content is moderate.

Nearly all of the acreage of this soil supports native grasses and is used as range. The soil generally is not suitable as cropland because of the slope and the hazards of soil blowing and water erosion.

In the areas used as range, the climax vegetation is dominantly blue grama, western wheatgrass, needleandthread, threadleaf sedge, and buffalograss. These species make up 75 percent or more of the total annual forage. Little bluestem, sideoats grama, plains muhly, prairie junegrass, green needlegrass, sand dropseed, Sandberg bluegrass, and sedges make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, and prairie junegrass decrease in abundance and are replaced by blue grama, buffalograss, needleandthread, plains muhly, sand dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought, water erosion, and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is not suited to sanitary facilities because of the slope. A suitable alternative site should be selected. Dwellings should to be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. Cutting and filling can provide a suitable grade for roads. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is VIe-3, dryland; Silty range site; windbreak suitability group 3.

BxE—Busher-Tassel loamy very fine sands, 9 to 20 percent slopes. These moderately steep, well drained soils are on uplands. They formed in sandy and loamy material weathered from sandstone bedrock. The Busher soil is deep and is on the mid and lower side slopes. The Tassel soil is shallow and is on narrow ridges in the uplands, sharp breaks of slopes, and dissected side slopes. Areas range from 5 to 185 acres in size. They are 40 to 65 percent Busher soil and 20 to 40 percent Tassel soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Busher soil has a surface layer of grayish brown, very friable loamy very fine sand about 7 inches thick. The subsoil is light brownish gray, very friable loamy very fine sand about 11 inches thick. The underlying material is about 30 inches thick. It is light brownish gray loamy very fine sand in the upper part and light gray, calcareous loamy very fine sand in the lower part. White, calcareous sandstone bedrock is at a depth of about 48 inches. In some places carbonates are below a depth of 48 inches. In other places the subsoil has more clay. In some areas the surface layer is lighter in color. In other areas sandstone bedrock is below a depth of 60 inches.

Typically, the Tassel soil has a surface layer of brown, very friable, calcareous loamy very fine sand about 4 inches thick. The underlying material extends to a depth of 12 inches. It is light brownish gray, calcareous loamy very fine sand. White, calcareous sandstone bedrock is at a depth of about 16 inches. In places sandstone bedrock is at a depth of less than 6 inches.

Included with these soils in mapping are small areas of Creighton, Sidney, and Vetal soils and outcrops of gravel and sandstone bedrock. Creighton soils do not have sandstone bedrock at a depth of less than 60 inches. They are in landscape positions similar to those of the Busher soil. Sidney soils have less sand and more silt and clay than the Busher soil. Also, they are lower on the landscape. Vetal soils have a dark surface soil that is more than 20 inches thick. They are in swales. The outcrops of gravel are on the small higher knolls, and the outcrops of sandstone bedrock are on the narrow ridgetops and sharp breaks of slopes. Included areas make up 10 to 25 percent of the unit.

Permeability is moderately rapid in the Busher and Tassel soils. The available water capacity is moderate

in the Busher soil and very low in the Tassel soil. Runoff is rapid on both soils. The organic matter content is moderately low in the Busher soil and low in the Tassel soil.

Nearly all of the acreage of these soils is used as range. The soils are generally not suited to farming because of the slope and the hazards of soil blowing and water erosion.

If these soils are used as range, the climax vegetation in areas of the Busher soil is dominantly prairie sandreed, needleandthread, blue grama, and sand bluestem. These species make up 70 percent or more of the total annual forage on this soil. Threadleaf sedge, Indian ricegrass, little bluestem, perennial grasses, and sedges make up the rest. The climax vegetation in areas of the Tassel soil is dominantly blue grama, little bluestem, threadleaf sedge, and needleandthread. These species make up 60 percent or more of the total annual forage on this soil. Prairie sandreed, sand bluestem, sideoats grama, plains muhly, and forbs make up the rest. If the Busher soil is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If the Tassel soil is subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site or the less desirable woody plants increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre on the Busher soil and 0.3 animal unit month per acre on the Tassel soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. In some areas brush management may be needed to control the woody plants that invade the site. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

The Busher soil is suited to the trees and shrubs grown as windbreaks. The Tassel soil is not suited to the trees and shrubs grown as windbreaks because of the very low available water capacity and the shallow rooting depth. Onsite investigation is needed before planning a windbreak in areas of these soils. Soil blowing, drought, and water erosion are the main hazards in areas of the Busher soil. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

A poor filtering capacity in the Busher soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The Busher soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. Land shaping and installing the septic tank absorption fields on the contour help to ensure that the fields function properly. The Tassel soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The soft bedrock generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations. The sides of shallow excavations in areas of the Busher soil can cave in unless they are shored. Cutting and filling can provide a suitable grade for roads.

The land capability unit is VIe-5, dryland. The Busher soil is in the Sandy range site and windbreak suitability group 7. The Tassel soil is in the Shallow Limy range site and windbreak suitability group 10.

CaF—Canyon loam, 9 to 30 percent slopes. This shallow, moderately steep and steep, well drained soil formed in calcareous, loamy material weathered from sandstone bedrock on side slopes and ridgetops in the uplands. Areas range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous loam about 4 inches thick. Next is a transitional layer that also is grayish brown, very friable, calcareous loam. It is about 6 inches thick. The underlying material extends to a depth of 16 inches. It is pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 16 inches. In some places the surface layer is lighter in color. In other places it is fine sandy loam or very fine sandy loam.

Included with this soil in mapping are small areas of Busher, Eckley, Sidney, and Vetal soils. Busher and Sidney soils have sandstone bedrock at a depth of 40 to 60 inches. Busher soils have more sand throughout

than the Canyon soil. Eckley soils are less than 20 inches deep to sand and gravel. Vetal soils do not have sandstone bedrock within a depth of 60 inches. They are dark to a depth of more than 20 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Canyon soil, and the available water capacity is very low. Runoff is rapid. The organic matter content is low.

Nearly all the acreage of this soil supports native grasses and is used as range. The soil is not suited to cultivated crops because of the shallow rooting depth and the slope.

In the areas used as range, the climax vegetation is dominantly little bluestem, threadleaf sedge, sideoats grama, and blue grama. These species make up 55 percent or more of the total annual forage. Needleandthread, hairy grama, big bluestem, western wheatgrass, plains muhly, annual grasses, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If overgrazing continues for many years, the less desirable woody plants may increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. In some areas brush management may by needed to control woody plants that invade the site.

This soil generally is not suited to the trees and shrubs grown as windbreaks because of the shallow rooting depth and the very low available water capacity.

This soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. A suitable alternative site should be selected. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The soft bedrock generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations and the construction of roads. Cutting and filling can provide a suitable grade for roads.

The land capability unit is VIs-4, dryland; Shallow Limy range site; windbreak suitability group 10.

CgG—Canyon-Rock outcrop complex, 20 to 60 percent slopes. This map unit occurs as areas of a steep and very steep, well drained Canyon soil intermingled with areas of sandstone outcrops. The Canyon soil is shallow and is on side slopes and narrow ridgetops in the uplands. It formed in calcareous, loamy material weathered from sandstone bedrock. The Rock outcrop is on ridgetops and the upper parts of side slopes in the uplands. Individual areas range from 50 to several hundred acres in size. They are 40 to 60 percent Canyon soil and 25 to 45 percent Rock outcrop. They are so intricately mixed that separating them in mapping is not practical.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 4 inches thick. Next is a transitional layer of light brownish gray, very friable, calcareous loam about 3 inches thick. The underlying material extends to a depth of 15 inches. It is very pale brown, calcareous very fine sandy loam. White, calcareous sandstone bedrock is at a depth of about 15 inches. In some places the surface layer is lighter in color. In other places it is fine sandy loam or very fine sandy loam.

Typically, the areas of Rock outcrop consist of fine grained, calcareous sandstone bedrock. In places siltstone bedrock and unconsolidated material are interlayered.

Included in mapping are small areas of Busher, Eckley, Sidney, and Vetal soils. Busher and Vetal soils have more sand throughout than the Canyon soil. Busher soils have sandstone bedrock at a depth of 40 to 60 inches. Vetal soils have a dark surface soil that is more than 20 inches thick. Eckley soils are shallow over gravelly sediments. They are higher on the landscape then the Canyon soil. Sidney and Vetal soils are lower on the landscape than the Canyon soil and the Rock outcrop. Sidney soils have bedrock at a depth of 40 to 60 inches. Included soils make up 10 to 25 percent of the unit.

Permeability is moderate in the Canyon soil, and the available water capacity is very low. Runoff is very rapid. The organic matter content is low.

All of the acreage in this map unit supports native grasses and is used as range or wildlife habitat. The unit is not suited to cultivated crops or to the trees and shrubs grown as windbreaks because of the shallow rooting depth, the outcrops of sandstone bedrock, and the slope.

If the Canyon soil is used as range, the climax vegetation is dominantly little bluestem, threadleaf sedge, sideoats grama, and blue grama. These species make up 55 percent or more of the total annual forage. Needleandthread, hairy grama, big bluestem, western wheatgrass, plains muhly, annual grasses, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by

sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If overgrazing continues for many years, the less desirable woody plants may increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope can hinder the movement of livestock from one area to another. In some areas brush management may by needed to control woody plants that invade the site.

The Canyon soil is not suited to septic tank absorption fields or buildings because of the shallow depth to bedrock and the slope. A suitable alternative site should be selected. The soft bedrock generally can be excavated during the construction of roads. Cutting and filling can provide a suitable grade for roads.

The land capability unit is VIIs-4, dryland. The Canyon soil is in the Shallow Limy range site and windbreak suitability group 10. The areas of Rock outcrop are not assigned to a range site or a windbreak suitability group.

CnE—Canyon-Sidney loams, 9 to 20 percent slopes. These moderately steep, well drained soils are on uplands. The Canyon soil is shallow and is on narrow ridgetops and the convex shoulders of dissected side slopes. It formed in calcareous, loamy material weathered from sandstone bedrock. The Sidney soil is deep and is on foot slopes and the lower side slopes. It formed in calcareous, loamy material. Areas range from 5 to 1,000 acres in size. They are 30 to 60 percent Canyon soil and 20 to 45 percent Sidney soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 6 inches thick. The underlying material extends to a depth of 14 inches. It is pale brown, very friable, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 14 inches. In places the depth to bedrock is less than 6 inches.

Typically, the Sidney soil has a surface layer of brown, very friable loam about 4 inches thick. The subsurface layer is brown, very friable very fine sandy loam about 10 inches thick. The subsoil is very friable, calcareous very fine sandy loam about 18 inches thick. It is brown in upper part and very pale brown in the lower part. The underlying material extends to a depth of 41 inches. It is light gray, calcareous sandy loam. White, calcareous sandstone bedrock is at a depth of about 41 inches. In places the surface layer is lighter in color.

Included with these soils in mapping are small areas of Altvan, Bayard, Bridget, and Eckley soils and outcrops of calcareous sandstone bedrock. Altvan soils have more clay in the subsoil than the Canyon and Sidney soils and are higher on the landscape. They are moderately deep over gravelly coarse sand. Bayard and Bridget soils generally have less clay throughout than the Canyon and Sidney soils and are lower on the landscape. Eckley soils are shallow over gravelly coarse sand. They are in landscape positions similar to those of the Canyon and Sidney soils. The outcrops of sandstone bedrock are on the shoulders and summit of ridgetops. Included areas make up 15 to 25 percent of the unit.

Permeability is moderate in the Canyon and Sidney soils. The available water capacity is very low in the Canyon soil and moderate in the Sidney soil. Runoff is rapid on both soils. The organic matter content is low in the Canyon soil and moderate in the Sidney soil.

Most of the acreage of these soils supports native grasses and is used as range. The soils are not suited to farming because of the slope.

If these soils are used as range, the climax vegetation in areas of the Canyon soil is dominantly little bluestem, threadleaf sedge, sideoats grama, and blue grama. These species make up 55 percent or more of the total annual forage on this soil. Needleandthread, hairy grama, big bluestem, western wheatgrass, plains muhly, annual grasses, and forbs make up the rest. The climax vegetation in areas of the Sidney soil is dominantly western wheatgrass, needleandthread, and blue grama. These species make up 70 percent or more of the total annual forage on this soil. Sedges, buffalograss, annual grasses, and forbs make up the rest. If the Canyon soil is subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If the Sidney soil is subject to continuous heavy grazing, big bluestem, little bluestem, prairie junegrass, and switchgrass decrease in abundance and are replaced by blue grama, buffalograss, needleandthread, plains muhly, sand dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. Less desirable woody plants may increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre on the Canyon soil and 0.5 animal unit month per acre on

the Sidney soil. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. In some areas brush management may by needed to control woody plants that invade the site. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

The Canyon soil generally is not suited to the trees and shrubs grown as windbreaks because of the shallow depth to bedrock. The Sidney soil is suited to the trees and shrubs grown as windbreaks. Onsite investigation is needed before planning a windbreak in areas of these soils. The main hazards are soil blowing, drought, and water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation between the tree rows with conventional equipment and by timely applications of the appropriate herbicide.

The Canyon soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. A suitable alternative site should be selected. A poor filtering capacity in the Sidney soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The moderate permeability is an additional limitation on sites for septic tank absorption fields in areas of the Sidney soil. It generally can be overcome by increasing the size of the field. Land shaping and installing the septic tank absorption fields on the contour help to ensure that the absorption fields function properly. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The soft bedrock generally can be excavated during the construction of houses with basements or buildings that have deep foundations. Cutting and filling can provide a suitable grade for roads. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage in areas of the Sidney soil. The damage to roads caused by frost action can be minimized by a good surface drainage system.

The land capability unit is VIs-4, dryland. The Canyon soil is in the Shallow Limy range site and windbreak suitability group 10. The Sidney soil is in the Silty range site and windbreak suitability group 3.

CnE2—Canyon-Sidney loams, 9 to 20 percent slopes, eroded. These moderately steep, well drained soils are on uplands. The Canyon soil is shallow and is on narrow ridgetops and the convex shoulders of dissected side slopes. It formed in calcareous, loamy material weathered from sandstone bedrock. The Sidney soil is deep and is on foot slopes and side slopes. It formed in calcareous, loamy material. In areas of these soils, the surface layer is light in color because all or most of the original surface soil has been removed by erosion and tillage has mixed the remaining surface soil with the subsoil or underlying material. Areas range from 5 to 1,000 acres in size. They are 30 to 60 percent Canyon soil and 20 to 45 percent Sidney soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 4 inches thick. The underlying material extends to a depth of about 7 inches. It is pale brown, very friable, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 14 inches.

Typically, the Sidney soil has a surface layer of grayish brown, very friable, calcareous loam about 5 inches thick. The subsoil is very friable, calcareous very fine sandy loam about 19 inches thick. It is brown in the upper part and very pale brown in the lower part. The underlying material extends to a depth of 41 inches. It is very pale brown, calcareous fine sandy loam. White, calcareous sandstone bedrock is at a depth of about 41 inches. In places sandstone bedrock outcrops on the convex ridgetops and the upper side slopes.

Included with these soils in mapping are small areas of Bayard, Bridget, and Vetal soils and outcrops of gravel and sandstone bedrock. Bayard, Bridget, and Vetal soils are lower on the landscape than the Canyon and Sidney soils and have less clay throughout. Vetal soils have a dark surface layer that is more than 20 inches thick. Included areas make up 10 to 20 percent of the unit.

Permeability is moderate in the Canyon and Sidney soils. The available water capacity is very low in the Canyon soil and moderate in the Sidney soil. Runoff is rapid on both soils. The organic matter content is low. The water intake rate for irrigation is moderate in the Sidney soil. The Sidney soil has good tilth.

A large acreage of these soils has been farmed in the past, but the soils generally are not suited to

farming because of the slope and the hazard of erosion. A few areas have been reseeded to native grasses and are used for grazing.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

The Canyon soil generally is not suited to the trees and shrubs grown as windbreaks because of the shallow depth to bedrock. The Sidney soil is suited to the trees and shrubs grown as windbreaks. Onsite investigation is needed before planning a windbreak in areas of these soils. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Canyon soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. A suitable alternative site should be selected. A poor filtering capacity in the Sidney soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The poor filtering capacity can result in the pollution of nearby water supplies. The moderate permeability is an additional limitation on sites for septic tank absorption fields in areas of the Sidney soil. It generally can be overcome by increasing the size of the field. Land shaping and installing the septic tank absorption fields on the contour help to ensure that the fields function properly. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The soft bedrock generally can be excavated during the construction of houses with basements or buildings that have deep foundations. Cutting and filling can provide a suitable grade for roads. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage in areas of the Sidney soil.

The land capability unit is VIs-4, dryland. The Canyon soil is in the Shallow Limy range site and windbreak suitability group 10. The Sidney soil is in the Silty range site and windbreak suitability group 3.

CrB—Creighton very fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loamy sediments on uplands. Areas range from 3 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 7 inches thick. The subsoil is pale brown, very friable very fine sandy loam about 26 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface layer is dark or is more than 20 inches thick. In other places it is less than 7 inches thick. In some areas it is lighter in color. In other areas the subsoil has more clay.

Included with this soil in mapping are small areas of Duroc and Satanta soils. These soils have more clay than the Creighton soil. Duroc soils are dark to a depth of more than 20 inches. They are in swales. Satanta soils are in landscape positions similar to those of the Creighton soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Creighton soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderate. Tilth is good.

Most of the acreage of this soil is irrigated or is used for dryland farming. A few small areas support native grasses and are used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing, water erosion, and drought are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control soil blowing and maintain fertility.

Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. This soil generally is suited to dwellings and roads.

The land capability units are IIIe-3, dryland, and IIe-6, irrigated; Silty range site; windbreak suitability group 3.

CrC—Creighton very fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loamy sediments on uplands. Areas range from 5 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 7 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 4 inches thick. The subsoil is light brownish gray and is about 14 inches thick. It is very friable very fine sandy loam in the upper part and calcareous very fine sandy loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places sandstone bedrock is at a depth of 40 to 60 inches. In other places the surface soil is more than 20 inches thick or less than 7 inches thick. In some areas the subsoil has more clay.

Included with this soil in mapping are small areas of Duroc and Satanta soils. These soils have more clay than the Creighton soil. Duroc soils are dark to a depth of more than 20 inches. They are in swales. Satanta soils are in landscape positions similar to those of the Creighton soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Creighton soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderately low. The water intake rate is moderate. Tilth is good.

Most of the acreage of this soil is used for dryland farming. A few small areas support native grasses and are used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Terracing reduces the runoff rate and helps to control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are hazards. Managing irrigation water and applying a system of conservation tillage that keeps crop residue on the surface help to control soil blowing and water erosion.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. This soil generally is suited to dwellings and roads.

The land capability units are IIIe-3, dryland, and IIIe-6, irrigated; Silty range site; windbreak suitability group 3.

DtB—Dix sandy loam, 0 to 3 percent slopes. This nearly level and very gently sloping, excessively drained soil is shallow over gravelly sediments. It is on the breaks to stream terraces, on alluvial fans, and on foot

slopes. Areas range from 5 to several hundred acres in size.

Typically, the surface layer is grayish brown, very friable sandy loam about 10 inches thick. Next is a transitional layer of light brownish gray, very friable sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray. It is gravelly coarse sand in the upper part and very gravelly coarse sand in the lower part. In some places the surface layer is fine sandy loam or loamy sand. In other places the soil has more clay and less sand. In some areas the depth to the underlying gravelly coarse sand is more than 20 inches.

Included with this soil in mapping are small areas of Bayard soils. These soils have less sand than the Dix soil. Also, they are lower on the landscape. They do not have gravelly coarse sand at a depth of less than 60 inches. They make up 5 to 15 percent of the unit.

Permeability is rapid in the solum of the Dix soil and very rapid in the underlying material. The available water capacity is very low. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderately high.

About half the acreage of this soil is used as cropland. Some areas are irrigated. The remaining acreage supports native grasses and is used as range. The soils are not suited to dryland farming because of the very low available water capacity and droughtiness.

If irrigated, this soil is poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation is best suited to the soil. Soil blowing is a hazard. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control soil blowing and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility.

In the areas used as range, the climax vegetation is dominantly blue grama, sand dropseed, Fendler threeawn, and needleandthread. These species make up 55 percent or more of the total annual forage. Sand bluestem, little bluestem, hairy grama, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, common pricklypear, brittle pricklypear, fringed sagewort, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to keep little bluestem and prairie sandreed in the plant community. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The very low available water capacity and droughtiness are limitations. The amount of forage produced depends on the frequency and amount of seasonal rainfall.

This soil generally is not suited to the trees and shrubs grown as windbreaks because of the very low available water capacity and droughtiness.

This soil is not suited to septic tank absorption fields because of a poor filtering capacity. A suitable alternative site should be selected. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are shored. This soil is suited to dwellings and roads.

The land capability units are VIs-4, dryland, and IVs-14, irrigated; Shallow to Gravel range site; windbreak suitability group 10.

Dw—Duroc loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in loamy alluvial and colluvial sediments along upland drainageways. It is subject to rare flooding. Areas range from 5 to 300 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 7 inches thick. The subsurface layer also is grayish brown, very friable loam. It is about 14 inches thick. Next is a transitional layer of brown, calcareous loam about 6 inches thick. The underlying material to a depth of 60 inches or more is pale brown, calcareous loam. In some places the surface soil is less than 20 inches thick. In other places it is very fine sandy loam. In some areas the subsoil has less clay and more sand.

Included with this soil in mapping are small areas of Goshen soils. These soils have more clay than the Duroc soil. Also, they are lower on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Duroc soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

Most of the acreage of this soil is used for dryland

farming or is irrigated. Some areas support native grasses and are used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. The lack of precipitation is a major limitation. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the soil with cover crops or crop residue during the winter helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

Septic tank absorption fields function well in areas of this soil that are protected from floodwater. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. Constructing dwellings on raised, well compacted fill material helps to prevent the damage caused by flooding. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIc-1, dryland, and I-6, irrigated; Silty Lowland range site; windbreak suitability Group 1.

DwB—Duroc loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loamy alluvial and colluvial sediments on uplands. Areas range from 10 to 225 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 7 inches thick. The subsurface layer is dark grayish brown and grayish brown, friable loam about 18 inches thick. Next is a transitional layer of brown, friable loam about 9 inches thick. The underlying material to a depth of 60 inches or more is pale brown, calcareous loam. In some places it has more clay. In other places the soil has less clay and more sand. In some areas carbonates are leached to a depth of more than 36 inches. In other areas the surface soil is less than 20 inches thick.

Included with this soil in mapping are small areas of Goshen soils. These soils have more clay than the Duroc soil. They are in swales or shallow depressions. They make up 5 to 15 percent of the unit.

Permeability is moderate in the Duroc soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

A large acreage of this soil is farmed. Most areas are used for dryland farming, but some are irrigated. The remaining acreage supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion. Returning crop residue to the soil

and minimizing tillage help to control erosion and maintain fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The foundation of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

The land capability units are IIIe-1, dryland, and IIe-6, irrigated; Silty range site; windbreak suitability group 3.

EcF—Eckley gravelly sandy loam, 3 to 30 percent slopes. This gently sloping to steep, well drained soil is shallow over gravelly sediments and is on ridgetops and side slopes in the uplands. Areas range from 5 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, very friable gravelly sandy loam about 7 inches thick. The subsoil is also about 7 inches thick. It is dark brown, firm gravelly sandy clay loam. The underlying material extends to a depth of 60 inches or more. It is brown very gravelly sand in the upper part and very pale brown gravelly sand in the lower part. In some places the surface layer is loamy coarse sand. In other places the soil has less clay in the subsoil. In some areas the depth to the underlying gravelly sand is more than 20 inches.

Included with this soil in mapping are small areas of Altvan, Busher, and Tassel soils. These soils are lower on the landscape than the Eckley soil. Altvan soils have gravelly coarse sand at a depth of 20 to 40 inches. Busher soils have more sand and less clay than the Eckley soil. They have sandstone bedrock at a depth of 40 to 60 inches. Tassel soils have sandstone bedrock at a depth of 10 to 20 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Eckley soil, and the available water capacity is low. Runoff is medium or rapid. The organic matter content is moderate.

Nearly all of the acreage of this soil supports native grasses and is used as range. The soils are not suited to farming because of the slope, the low available water capacity, and droughtiness.

In the areas used as range, the climax vegetation is dominantly blue grama, western wheatgrass, and thickspike wheatgrass. These species make up 65 percent or more of the total annual forage. Needleandthread, threadleaf sedge, prairie sandreed, green needlegrass, sideoats grama, little bluestem, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, common pricklypear, brittle pricklypear, fringed sagewort, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A planned, short period of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to keep little bluestem and prairie sandreed in the plant community. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

The low available water capacity and droughtiness are limitations. The amount of forage produced depends on the frequency and amount of seasonal rainfall. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil generally is not suited to the trees and shrubs grown as windbreaks. The slope and droughtiness are limitations affecting the planting, survival, and growth of trees and shrubs. Onsite investigation is needed to locate areas that may be suitable for windbreaks.

This soil is not suited to septic tank absorption fields because of a poor filtering capacity and the slope. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. Dwellings should be designed so that they conform to the natural slope of the land, or building

sites should be graded to a suitable gradient. The sides of shallow excavations can cave in unless they are shored. Cutting and filling can provide a suitable grade for roads.

The land capability unit is VIs-4, dryland; Shallow to Gravel range site; windbreak suitability group 10.

EkF—Epping silt loam, 9 to 30 percent slopes. This shallow, moderately steep and steep, well drained soil formed in material weathered from siltstone bedrock. It is on knolls, dissected side slopes, and narrow ridgetops in the uplands. Areas range from 10 to 200 acres in size.

Typically, the surface layer is pale brown, very friable silt loam about 5 inches thick. Next is a transitional layer of pale brown, very friable, calcareous silt loam about 3 inches thick. The underlying material to a depth of 15 inches is pale brown, calcareous silt loam. Pale brown siltstone bedrock is at a depth of about 15 inches. In a few areas the surface layer is dark.

Included with this soil in mapping are small areas of Bridget, Dix, and Mitchell soils and outcrops of siltstone and sandstone bedrock. Bridget soils are deep. They have a surface soil that is darker and thicker than that of the Epping soil. They are on foot slopes. Dix soils are shallow over very gravelly coarse sand. They are on ridgetops and breaks. Mitchell soils are deep. They are on foot slopes and alluvial fans. The outcrops of siltstone and sandstone bedrock are on the sharp breaks of slopes. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Epping soil, and the available water capacity is low. Runoff is rapid. The organic matter content is low.

Nearly all of the acreage of this soil supports native grasses and is used as range. The soil is not suited to farming because of the shallow rooting depth and the slope.

In the areas used as range, the climax vegetation is dominantly blue grama, threadleaf sedge, needleandthread, sideoats grama, and little bluestem. These species make up 65 percent or more of the total annual forage. Buffalograss, western wheatgrass, prairie sandreed, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, the less desirable woody plants may increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. In some areas brush management may be needed to control the woody plants that invade the site.

This soil generally is not suited to the trees and shrubs grown as windbreaks because of the shallow depth to bedrock.

This soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. A suitable alternative site should be selected. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The bedrock generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations. Cutting and filling can provide a suitable grade for roads.

The land capability unit is VIs-4, dryland; Shallow Limy range site; windbreak suitability group 10.

Gg—Glenberg very fine sandy loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil formed in stratified, loamy and sandy alluvium on bottom land. It is occasionally flooded for very brief periods. Areas range from 5 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches or more is pale brown, calcareous very fine sandy loam that has thin lenses of sand, loamy sand, and fine sandy loam. In some places the surface layer is dark to a depth of 7 inches or more. In other places it is loamy sand or loamy fine sand.

Included with this soil in mapping are small areas of Bankard, Bayard, and Otero soils. Bankard soils have more sand than the Glenberg soil. Also, they are lower on the landscape. Bayard and Otero soils are higher on the landscape than the Glenberg soil. They are not stratified. Bayard soils have a dark surface soil that is thicker than that of the Glenberg soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Glenberg soil, and the available water capacity is moderate. Runoff is slow. The organic matter content is low. The water intake rate is moderately high. Tilth is good.

A small acreage of this soil is irrigated or is used for dryland farming. The rest supports native grasses and is used as range.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. The major hazard is flooding following periods of heavy local rainfall. Flooding is of short duration, and crop damage is seldom severe. Constructing diversions and dikes can

create a barrier that helps to control flooding in some areas. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing is a hazard. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the sandy underlying material in places. Returning crop residue to the soil and minimizing tillage help to control soil blowing and maintain fertility. Protecting the soil with cover crops or crop residue during the winter helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Weeds and grasses can be controlled by cultivation with conventional equipment and by applications of the appropriate herbicide.

This soil is not suited to septic tank absorption fields or building site development because of the flooding. A suitable alternative site should be selected. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding.

The land capability units are IIIw-3, dryland, and IIw-8, irrigated; Sandy Lowland range site; windbreak suitability group 1L.

Go—Goshen loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in colluvial and alluvial material derived from loess. It is in swales on uplands and is subject to rare flooding. Areas range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 7 inches thick. The subsurface layer also is dark grayish brown, very friable loam. It is about 5 inches thick. The subsoil is about 28 inches thick. It is grayish brown, friable silty clay loam in the upper part; dark grayish brown, friable silty clay loam in the next part; and pale brown, very friable silt loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous loam. In some places the surface layer is very fine sandy loam. In other places the upper part of the subsoil is silt loam or loam. In a few areas sandstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Alliance, Keith, and Lodgepole soils. Alliance and Keith soils are higher on the landscape than the Goshen soil. They have a surface soil less than 20 inches thick. Alliance soils have sandstone bedrock at a depth of 40 to 60 inches. Lodgepole soils have more clay in the subsoil than the Goshen soil. They are in depressions on uplands. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Goshen soil, and the available water capacity is high. Runoff is very slow. The organic matter content is moderate. The water intake rate is moderately low. Tilth is good.

Nearly all of the acreage of this soil is used for dryland farming. The rest supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. The lack of precipitation is a major limitation. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. A conservation tillage system, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and soil

blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

Septic tank absorption fields function well in areas of this soil that are protected from floodwater. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. Constructing dwellings on raised, well compacted fill material helps to prevent the damage caused by flooding. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

The land capability units are IIIc-1, dryland, and I-4, irrigated; Silty Lowland range site; windbreak suitability group 1.

Ja—Janise loam, 0 to 2 percent slopes. This deep, nearly level, very strongly alkaline, somewhat poorly drained soil formed in loamy and sandy alluvium on bottom land. It is occasionally flooded for brief periods. Areas range from 5 to more than 200 acres in size.

Typically, the surface layer is light brownish gray, very friable, calcareous loam about 2 inches thick. The subsoil also is light brownish gray, friable, calcareous loam. It is about 16 inches thick. The underlying material extends to a depth of 60 inches or more. It is mottled, light gray, calcareous loam in the upper part and light gray, calcareous loamy very fine sand in the lower part. In some places the surface layer is darker and thicker. In other places the subsoil is finer textured and has strata of silty clay or clay. In some areas it is coarser textured and has strata of fine sandy loam, sandy loam, and loamy very fine sand.

Included with this soil in mapping are small areas of Lisco and Yockey soils. These soils are in landscape positions similar to those of the Janise soil. Lisco soils have more sand in the upper part of the profile than the Janise soil. Yockey soils do not have a very strongly alkaline subsoil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Janise soil, and the available water capacity is moderate. Runoff is slow. The seasonal high water table ranges from a depth of about 2 feet during wet years to about 3 feet during dry years. The organic matter content is low. This soil has excessive amounts of sodium and other salts.

Most of the acreage of this soil supports native grasses and is used as range. The soil is not suited to farming because of the high alkalinity. This limitation generally is not practical to overcome.

In the areas used as range or hayland, the climax vegetation is dominantly alkali sacaton, inland saltgrass, and western wheatgrass. These species make up 65 percent or more of the total annual forage. Slender wheatgrass, plains bluegrass, foxtail barley, switchgrass, sand dropseed, blue grama, sedges, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, alkali sacaton, western wheatgrass, and switchgrass decrease in abundance and are replaced by inland saltgrass, blue grama, bluegrass, foxtail barley, sand dropseed, and alkali-tolerant sedges. If overgrazing or improper haying continues for many years, inland saltgrass, blue grama, bluegrass, foxtail barley, alkali-tolerant sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The alkalinity limits forage production and greatly influences the kind of plants that grow. Some very strongly alkaline areas support little or no vegetation and are subject to severe soil blowing during dry periods. Careful management is needed to maintain the plant cover.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws.

This soil is not suited to the trees and shrubs grown as windbreaks because it is strongly alkaline.

This soil is not suited to sanitary facilities and building site development because of the flooding and wetness. A suitable alternative site should be selected. Constructing roads and streets on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding and wetness. The damage to roads and streets caused by frost action can be minimized by a good surface drainage system and by a moisture barrier of gravel in the subgrade. Crowning the roads and streets by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is VIs-1, dryland; Saline Subirrigated range site; windbreak suitability group 10.

Ke—Keith loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in loess on uplands. Areas range from 10 to 440 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer also is grayish brown, very friable loam. It is about 3 inches thick. The subsoil is about 20 inches thick. It is brown, friable silty clay loam in the upper part; pale brown, friable loam in the next part; and very pale brown, very friable, calcareous loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface soil is more than 20 inches thick. In other places the subsoil has less clay. In some areas the lower part of the underlying material is fine sand or loamy sand.

Included with this soil in mapping are small areas of Lodgepole soils. These soils have more clay in the subsoil than the Keith soil. They are in depressions or swales that are subject to ponding. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Keith soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately low. Tilth is good.

Nearly all of the acreage of this soil is used as cropland. A few small areas are irrigated. The remaining acreage supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. The lack of precipitation is a major limitation. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the loess or the sandy underlying material. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation between the tree rows with conventional equipment and by timely applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The foundation of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

The land capability units are IIIc-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 3.

KeB—Keith loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loess on uplands. Areas range from 40 to 320 acres in size.

Typically, the surface layer is grayish brown, friable loam about 7 inches thick. The subsoil is about 18 inches thick. It is grayish brown, firm silty clay loam in the upper part; grayish brown, firm loam in the next part; and light brownish gray, friable loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown and calcareous. It is loam in the upper part and very fine sandy loam in the lower part. In some places the subsoil has less clay. In other places carbonates are at the surface.

Included with this soil in mapping are small areas of Altvan, Duroc, and Lodgepole soils. Altvan soils are moderately deep over gravelly coarse sand. They are lower on the landscape than the Keith soil. Duroc soils have a dark surface soil that is more than 20 inches thick. They are in the lower concave areas of the landscape. Lodgepole soils have a clayey subsoil. They are in depressions that are subject to ponding. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Keith soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake

rate is moderately low. Tilth is good.

Nearly all of the acreage of this soil is used as cropland. A few small areas are irrigated. The remaining acreage supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Terracing reduces the runoff rate and helps to control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the loess or the sandy underlying material. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The foundation of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

The land capability units are IIIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 3.

KeC—Keith loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loess. It is on convex ridgetops and side slopes in the uplands. Areas range from 5 to 160 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 7 inches thick. The subsoil is about 20 inches thick. It is pale brown, friable silty clay loam in the upper part; pale brown, very friable loam in the next part; and white, calcareous loam in the lower part. The underlying material extends to a depth of 60 inches or more. It is very pale brown, calcareous loam in the upper part and pale brown very fine sandy loam in the lower part. In some cultivated areas, erosion has removed all or most of the original surface soil and tillage has mixed the remaining surface soil with the subsoil. In these areas the surface layer is lighter in color and is calcareous. In some places the surface layer is silty clay loam. In other places the lower part of the underlying material is sandy. In some areas the surface layer is dark to a depth of more than 20 inches.

Included with this soil in mapping are small areas of Canyon and Rosebud soils and areas of sandstone outcrops. Canyon soils are shallow over sandstone bedrock. They are on knolls and ridgetops. Rosebud soils are moderately deep over sandstone bedrock. They are on side slopes at the lower elevations. The sandstone outcrops are on the small knolls and the upper side slopes. Included areas make up 5 to 10 percent of the unit.

Permeability is moderate in the Keith soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate is moderately low. Tilth is good.

Nearly all of the acreage of this soil is used as cropland. A few small areas are irrigated. The remaining acreage supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves

fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, soil blowing, and water erosion are the main hazards. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or cover crops between the tree rows. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The foundation of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Coarser grained base material can be used to ensure better performance.

The land capability units are IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; windbreak suitability group 3.

Lc—Lisco fine sandy loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in loamy alluvium on bottom land. It is subject to rare flooding. Areas range from 5 to 200 acres in size.

Typically, the surface layer is light brownish gray, very friable fine sandy loam about 6 inches thick. The subsoil is light brownish gray, calcareous, very friable fine sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light gray and very pale brown, mottled, calcareous fine sandy loam. In places the subsoil has more clay.

Included with this soil in mapping are small areas of Janise and alkali Yockey soils. These soils have less sand than the Lisco soil. Also, they are lower on the landscape. They make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Lisco soil, and the available water capacity is moderate. Runoff is slow. The seasonal high water table ranges from a depth of about 1.5 feet during wet years to about 3.5 feet during dry years. The organic matter content is moderately low. The soil has excessive amounts of sodium and other salts.

Most of the acreage of this soil supports native grasses and is used for grazing or hay. The soil generally is not suited to farming and to the trees and shrubs grown as windbreaks because of the high alkalinity and salinity. These limitations generally are not practical to overcome.

In the areas used as range or hayland, the climax vegetation is dominantly alkali sacaton, western wheatgrass, and inland saltgrass. These species make up 75 percent or more of the total annual forage. Blue grama, sedges, plains bluegrass, slender wheatgrass, foxtail barley, switchgrass, sand dropseed, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, alkali sacaton, western wheatgrass, and switchgrass decrease in abundance and are replaced by inland saltgrass, blue grama, bluegrass, foxtail barley, sand dropseed, and alkali-tolerant sedges. If overgrazing or improper haying continues for many years, inland saltgrass, blue grama, bluegrass, foxtail barley, alkali-tolerant sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The alkalinity limits forage production and greatly influences the kind of plants that grow. Very strongly alkaline areas support little or no vegetation and are subject to severe soil blowing during dry periods. Careful management is needed to maintain the plant cover.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed in the spring, before the ground thaws.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the seasonal high water table. The sides of shallow excavations can cave in

unless they are shored. The shoring should be completed during a dry period. Constructing dwellings on raised, well compacted fill material helps to prevent the damage caused by flooding. Constructing roads on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by wetness and flooding. The damage to roads caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is VIs-1, dryland; Saline Subirrigated range site; windbreak suitability group 10.

Lo—Lodgepole silt loam, 0 to 1 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in loess in depressions on uplands. It is ponded following periods of heavy local rainfall. Areas range from 5 to 50 acres in size.

Typically, the surface layer is gray, very friable silt loam about 5 inches thick. The subsoil is about 44 inches thick. It is gray, friable silty clay loam in the upper part; dark gray silty clay in the next part; and very pale brown silt loam in the lower part. The underlying material to a depth of 60 inches or more is pale brown sandy loam.

Included with this soil in mapping are small areas of Goshen soils. These soils have a thicker surface soil and less clay in the subsoil than the Lodgepole soil. Also, they are higher on the landscape. They make up 5 to 10 percent of the unit.

Permeability is very slow in the Lodgepole soil, and the available water capacity is high. Moisture, however, is released slowly to plants. Runoff is very slow. Ponding may occur for short periods following heavy rainfall. It may occur for long periods in less than 5 out of 10 years. Because of a perched water table that ranges from about 0.5 foot above the surface during wet years to a depth of about 1.0 foot during dry years, the surface is saturated for long periods during the growing season. The water intake rate is low. The organic matter content is moderate. Tilth is difficult to maintain.

Most of the acreage of this soil is farmed. The rest supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. After periods of heavy rainfall, runoff from the adjacent areas saturates the surface layer. Because no natural outlets are available, the water ponds for long periods until it evaporates or is slowly absorbed by the soil. The excess water can delay tillage and can drown crops. Harvest also is often delayed. Puddling may occur if the soil is tilled when it is too wet. As it dries, the soil becomes hard and cannot be easily worked. A system of conservation tillage, such as disking or chiseling, that keeps crop residue on the surface helps to prevent puddling, improve tilth, and conserve soil moisture. Returning crop residue to the soil and applying feedlot manure increase the content of organic matter, minimize crusting, help to maintain tilth, and improve fertility and the rate of water intake.

If irrigated by sprinklers, this soil is poorly suited to wheat and corn because of the ponding. Sprinkler systems may cause additional ponding, and center-pivot sprinkler systems can stall during wet periods. Adjusting the application rate to the low rate of water intake helps to prevent the ponding.

This soil is suited to range and native hay. Continuous heavy grazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are highly tolerant of wetness. Site preparation and planting in spring may not be possible until the water is absorbed by the soil and the soil is sufficiently dry. Hand planting in the spring may be necessary because of the wetness. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment or by timely applications of the appropriate herbicide.

This soil is not suited to septic tank absorption fields because of the ponding and the very slow permeability. A suitable alternative site should be selected. Constructing dwellings on raised, well compacted fill material helps to prevent the damage caused by ponding. The foundation of buildings should be strengthened and backfilled with coarse material to prevent the damage caused by shrinking and swelling. Roads built on this soil need to be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Mixing the base material with additives, such as hydrated lime, can help prevent shrinking and swelling. Coarser grained base material can be used to ensure better performance.

The land capability units are IIIw-2, dryland, and IVw-2, irrigated; Clayey Overflow range site; windbreak suitability group 2W.

Mt—Mitchell very fine sandy loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in loamy colluvial and alluvial sediments that weathered

from siltstone bedrock. It is on valley foot slopes and broad alluvial fans. Areas range from 10 to more than 640 acres in size.

Typically, the surface layer is pale brown, very friable, calcareous very fine sandy loam about 7 inches thick. Next is a transitional layer that is also pale brown, very friable, calcareous very fine sandy loam. It is about 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface layer is darker. In other places it is loam or silt loam. In some areas siltstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Epping and Otero soils. Epping soils are shallow over siltstone bedrock. They are higher on the landscape than the Mitchell soil. Otero soils have more sand than the Mitchell soil. They are in landscape positions similar to those of the Mitchell soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Mitchell soil, and the available water capacity is high. Runoff is slow. The organic matter content is low. The water intake rate is moderate. Tilth is good.

Most of the acreage of this soil is cultivated. Most areas are dryland farmed, but a few are irrigated. The remaining acreage supports native grasses and is used for grazing.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. The lack of precipitation is a major limitation. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing is the main hazard. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings and roads. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field.

The land capability units are IIIc-1, dryland, and IIe-6, irrigated; Limy Upland range site; windbreak suitability group 8.

MtB—Mitchell very fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loamy colluvial and alluvial sediments weathered from siltstone bedrock. It is on valley foot slopes and alluvial fans. Areas range from 5 to more than 320 acres in size.

Typically, the surface layer is brown, very friable, calcareous very fine sandy loam about 6 inches thick. Next is a transitional layer of pale brown, very friable, calcareous very fine sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is pale brown and very pale brown, calcareous very fine sandy loam. In some places the surface soil is loam or silt loam. In other places the surface layer is darker. In some areas siltstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Epping and Otero soils. Epping soils are shallower over siltstone bedrock than the Mitchell soil. Also, they are higher on the landscape. Otero soils have more sand than the Mitchell soil. They are in landscape positions similar to those of the Mitchell soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Mitchell soil, and the available water capacity is high. Runoff is slow. The organic matter content is low. The water intake rate is moderate. Tilth is good.

Most of the acreage of this soil is used as cropland. The rest supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are slight hazards in areas where the surface is not adequately protected by crops or crop residue. A

system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are slight hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. The main hazards are drought, soil blowing, and water erosion. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings and roads. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field.

The land capability units are IIIe-3, dryland, and IIe-6, irrigated; Limy Upland range site; windbreak suitability group 8.

MtC—Mitchell very fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loamy colluvial and alluvial sediments weathered from siltstone bedrock. It is on valley foot slopes and alluvial fans. Areas range from 5 to 400 acres in size.

Typically, the surface layer is brown, very friable, calcareous very fine sandy loam about 3 inches thick. The subsurface layer also is brown, very friable, calcareous very fine sandy loam. It is about 8 inches thick. Next is a transitional layer of pale brown, very friable, calcareous very fine sandy loam about 4 inches thick. The underlying material to a depth of 60 inches or more is white, calcareous very fine sandy loam. In some places the surface soil is darker. In other places siltstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Epping and Otero soils and outcrops of siltstone bedrock. Epping soils are shallow over siltstone bedrock. They are higher on the landscape than the Mitchell soil. Otero soils have more sand than the Mitchell soil. They are in landscape positions similar to those of the Mitchell soil. The outcrops of siltstone bedrock are on the upper side slopes. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Mitchell soil, and the available water capacity is high. Runoff is medium. The organic matter content is low. The water intake rate is moderate. Tilth is good.

Most of the acreage of this soil is used for dryland farming. The rest supports native grasses and is used for grazing.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep

the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. The main hazards are water erosion and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings and roads. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field.

The land capability units are IIIe-3, dryland, and IIIe-6, irrigated; Limy Upland range site; windbreak suitability group 8.

MtD—Mitchell very fine sandy loam, 6 to 9 percent slopes. This deep, strongly sloping, well drained soil formed in loamy colluvial and alluvial sediments weathered from siltstone bedrock. It is on valley foot slopes and alluvial fans. Areas range from 5 to 200 acres in size.

Typically, the surface layer is brown, very friable, calcareous very fine sandy loam about 6 inches thick. Next is a transitional layer of pale brown, very friable, calcareous very fine sandy loam about 18 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface layer is darker. In other places siltstone bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Epping and Otero soils and outcrops of siltstone bedrock. Epping soils are shallow to siltstone bedrock. They are higher on the landscape than the Mitchell soil. Otero soils have more sand than the Mitchell soil. They are in landscape positions similar to those of the Mitchell soil. The outcrops of siltstone bedrock are on the upper side slopes. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Mitchell soil, and the available water capacity is high. Runoff is medium. The organic matter content is low. The water intake rate is moderate. Tilth is good.

About half the acreage of this soil is used as cropland, and about half is used as range. A few small areas of cropland are irrigated.

If dry-farmed, this soil is poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are severe hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. The main hazards are water erosion and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings and roads. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. Buildings should be designed so that they conform to the natural slope of the land, or the building sites should be graded to a suitable gradient.

The land capability units are IVe-3, dryland, and IVe-6, irrigated; Limy Upland range site; windbreak suitability group 8.

MxD—Mitchell-Epping complex, 3 to 9 percent slopes. These soils are gently sloping and strongly sloping and are well drained. The Mitchell soil is deep and is on alluvial fans and valley foot slopes. It formed in loamy colluvial and alluvial sediments weathered from siltstone bedrock. The Epping soil is shallow over siltstone bedrock and is on knolls, dissected side slopes, and ridgetops. It formed in material weathered from siltstone bedrock. Areas range from 5 to 300 acres in size. They are 40 to 60 percent Mitchell soil and 30 to 40 percent Epping soil. These two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the Mitchell soil has a surface layer of light brownish gray, very friable, calcareous very fine sandy loam about 6 inches thick. Next is a transitional layer of light gray, very friable, calcareous very fine sandy loam about 9 inches thick. The underlying material to a depth of 60 inches or more is white, calcareous very fine sandy loam. In some places the surface layer is darker. In other places siltstone bedrock is at a depth of 20 to 40 inches.

Typically, the Epping soil has a surface layer of light brownish gray, very friable, calcareous silt loam about 6 inches thick. Next is a transitional layer of light gray, very friable, calcareous silt loam about 4 inches thick. The underlying material extends to a depth of 14 inches. It is white, calcareous silt loam. Very pale brown siltstone bedrock is at a depth of 14 inches.

Included with these soils in mapping are small areas of Otero soils and outcrops of gravel or siltstone bedrock. Otero soils have more sand than the Mitchell and Epping soils. They are in landscape positions similar to those of the Mitchell and Epping soils. The outcrops of gravel and siltstone bedrock are on knolls and ridgetops. Included areas make up 10 to 20 percent of the unit.

Permeability is moderate in the Mitchell and Epping soils. The available water capacity is high in the Mitchell soil and low in the Epping soil. Runoff is medium on both soils. The organic matter content is low. The water intake rate is moderate.

Most of the acreage of these soils is farmed. A few small areas support native grasses and are used as range.

If dry-farmed, these soils are poorly suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are severe hazards if the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, these soils are poorly suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soils. Soil blowing and water erosion are severe hazards. A system of conservation tillage that keeps crop residue on the surface helps to control water erosion and soil blowing and conserve soil moisture. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

The Mitchell soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. Water erosion and soil blowing are hazards. The Epping soil is not suited to the trees and shrubs grown as windbreaks because of the shallow rooting depth. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Mitchell soil generally is suited to dwellings and roads. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. A poor filtering capacity in the Epping soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The Epping soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The Epping soil is suited to dwellings and roads. The soft bedrock in the Epping soil generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations. Buildings should be designed so that they conform to the natural slope of

the land, or building sites should be graded to a suitable gradient.

The land capability units are IVe-3, dryland, and IVe-6, irrigated. The Mitchell soil is in the Limy Upland range site and windbreak suitability group 8. The Epping soil is in the Shallow Limy range site and windbreak suitability group 10.

MxE—Mitchell-Epping complex, 9 to 20 percent slopes. These soils are moderately steep and well drained. The Mitchell soil is deep and is on alluvial fans and valley foot slopes. It formed in loamy colluvial and alluvial sediments weathered from siltstone bedrock. The Epping soil is shallow over siltstone bedrock and is on isolated knolls, dissected side slopes, and narrow ridgetops. It formed in material weathered from siltstone bedrock. Areas range from 5 to 300 acres in size. They are 40 to 60 percent Mitchell soil and 30 to 40 percent Epping soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Mitchell soil has a surface layer of brown, very friable very fine sandy loam about 6 inches thick. Next is a transitional layer of brown, very friable, calcareous very fine sandy loam about 3 inches thick. The underlying material to a depth of 60 inches or more is pale brown, calcareous very fine sandy loam. In some places the surface layer is darker. In other places siltstone bedrock is at a depth of 20 to 40 inches.

Typically, the Epping soil has a surface layer of light brownish gray, very friable, calcareous silt loam about 4 inches thick. Next is a transitional layer of pale brown, very friable, calcareous silt loam about 4 inches thick. The underlying material extends to a depth of 14 inches. It is pale brown, calcareous silt loam. Brown siltstone bedrock is at a depth of about 14 inches.

Included with these soils in mapping are small areas of Otero soils and outcrops of gravel and siltstone bedrock. Otero soils have more sand than the Mitchell and Epping soils. They are in landscape positions similar to those of the Mitchell and Epping soils. The outcrops of gravel and siltstone bedrock are on knolls and ridgetops. Included areas make up 10 to 20 percent of the unit.

Permeability is moderate in the Mitchell and Epping soils. The available water capacity is high in the Mitchell soil and low in the Epping soil. Runoff is rapid on both soils. The organic matter content is low.

Nearly all of the acreage of these soils supports native grasses and is used as range. The soils are not suited to farming because of the slope and the shallow rooting depth in areas of the Epping soil.

If these soils are used as range, the climax vegetation in areas of the Mitchell soil is dominantly blue grama, sideoats grama, buffalograss, needleandthread, threadleaf sedge, and western wheatgrass. These species make up 70 percent or more of the total annual forage on this soil. Little bluestem, prairie sandreed, plains muhly, and forbs make up the rest. The climax vegetation in areas of the Epping soil is dominantly blue grama, threadleaf sedge, needleandthread, little bluestem, and sideoats grama. These species make up 65 percent or more of the total annual forage on this soil. Buffalograss, western wheatgrass, prairie sandreed, and forbs make up the rest. If the Mitchell soil is subject to continuous heavy grazing, big bluestem and little bluestem decrease in abundance and are replaced by hairy grama, prairie sandreed, tall dropseed, western wheatgrass, needleandthread, plains muhly, sedges, and forbs. If the Epping soil is subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive and the less desirable woody plants may increase in abundance. In some areas brush management may be needed to control the woody plants that invade the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre on the Mitchell soil and 0.3 animal unit month per acre on the Epping soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

The Mitchell soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. Water erosion and soil blowing are the main hazards. The Epping soil is not suited to the trees and shrubs grown as windbreaks because of the shallow rooting depth. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation

with conventional equipment and by timely applications of the appropriate herbicide.

In areas of the Mitchell soil, land shaping and installing septic tank absorption fields on the contour help to ensure that the fields function properly. The Epping soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. A suitable alternative site should be selected. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient on both soils. The soft bedrock in areas of the Epping soil generally can be easily excavated during the construction of houses with basements or buildings with deep foundations. Cutting and filling can provide a suitable grade for roads on both soils.

The land capability unit is VIe-3, dryland. The Mitchell soil is in the Limy Upland range site and windbreak suitability group 8. The Epping soil is in the Shallow Limy range site and windbreak suitability group 10.

OfB—Otero loamy very fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil formed in sandy and loamy sediments on valley foot slopes and alluvial fans. Areas range from 50 to several hundred acres in size.

Typically, the surface layer is pale brown, very friable, calcareous loamy very fine sand about 6 inches thick. Next is a transitional layer of very pale brown, very friable, calcareous loamy very fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray and light brownish gray, calcareous loamy very fine sand. In some places the surface layer is loamy fine sand or very fine sandy loam. In other places it is darker.

Included with this soil in mapping are small areas of Mitchell and Valent soils. Mitchell soils have less sand than the Otero soil. They are in landscape positions similar to those of the Otero soil. Valent soils are sandy throughout and are leached of carbonates. They are generally on dunes. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Otero soil, and the available water capacity is moderate. Runoff is slow. The organic matter content is low. The water intake rate is high. Tilth is good.

About half the acreage of this soil supports native grasses and is used as range. The rest is used as cropland.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are slight hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Terracing helps to reduce the runoff rate and control water erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are slight hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the coarser textured material. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields, dwellings, and roads. The sides of shallow excavations can cave in unless they are shored.

The land capability units are IVe-5, dryland, and IIIe-10, irrigated; Sandy range site; windbreak suitability group 8.

OfD—Otero loamy very fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, well drained soil formed in sandy and loamy sediments on valley foot slopes and alluvial fans. Areas range from 5 to 80 acres in size.

Typically, the surface layer is brown, very friable, calcareous loamy very fine sand about 5 inches thick.

Next is a transitional layer of pale brown, very friable, calcareous loamy very fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is pale brown and very pale brown, calcareous loamy very fine sand. In some places the surface layer is darker. In other places it is leached of carbonates.

Included with this soil in mapping are small areas of Mitchell, Sarben, and Valent soils. Mitchell soils have less sand than the Otero soil. They are in landscape positions similar to those of the Otero soil. Sarben soils are deeper to carbonates than the Otero soil. Also, they are higher on the landscape. Valent soils are sandy and excessively drained. They are on the higher dunes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Otero soil, and the available water capacity is moderate. Runoff is medium. The organic matter content is low. The water intake rate is high. Tilth is good.

About half the acreage of this soil is used as cropland, and about half is used as range. The areas of cropland are mainly dryland farmed.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. The main hazards are water erosion and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields, dwellings, and roads. The sides of shallow excavations can cave in unless they are shored.

The land capability units are IVe-5, dryland, and IVe-10, irrigated; Sandy range site; windbreak suitability group 8.

OfE—Otero loamy very fine sand, 9 to 20 percent slopes. This deep, moderately steep, well drained soil formed in sandy and loamy sediments on foot slopes and alluvial fans. Areas range from 10 to several hundred acres in size.

Typically, the surface layer is brown, very friable loamy very fine sand about 5 inches thick. Next is a transitional layer of light brownish gray, very friable, calcareous loamy very fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is pale brown, calcareous loamy very fine sand. In places the surface layer is darker.

Included with this soil in mapping are small areas of Mitchell, Sarben, and Valent soils. Mitchell and Sarben soils are in landscape positions similar to those of the Otero soil. Mitchell soils have less sand than the Otero soil. Sarben soils are deeper to carbonates than the Otero soil. Valent soils are sandy and do not have carbonates. They are on dunes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Otero soil, and the available water capacity is moderate. Runoff is rapid. The organic matter content is low.

All of the acreage of this soil supports native grasses and is used for grazing. The soil is not suited to farming because of the slope and the severe hazard of water erosion.

In the areas used as range, the climax vegetation is dominantly blue grama, little bluestem, prairie sandreed, threadleaf sedge, sand bluestem, and sideoats grama. These species make up 75 percent or more of the total annual forage. Needleandthread, western wheatgrass, and other perennial grasses and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to

stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate an excessive amount of calcium carbonate. The main hazards are water erosion and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

Land shaping and installing septic tank absorption fields on the contour help to ensure that the fields function properly. The sides of shallow excavations can cave in unless they are shored. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. Cutting and filling can provide a suitable grade for roads.

The land capability unit is VIe-5, dryland; Sandy range site; windbreak suitability group 8.

OvG—Otero-Epping complex, 9 to 60 percent slopes. These soils are moderately steep to very steep (fig. 10). The Otero soil is deep and well drained and is on dissected foot slopes and alluvial fans. It formed in sandy and loamy sediments. The Epping soil is shallow over siltstone bedrock and somewhat excessively drained and is on side slopes along gullies. It formed in material weathered from siltstone bedrock. Areas range from 10 to several hundred acres in size. They are 50 to 60 percent Otero soil and 30 to 40 percent Epping soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Otero soil has a surface layer of grayish brown, very friable, calcareous loamy very fine sand about 6 inches thick. Next is a transitional layer of pale brown, very friable, calcareous loamy very fine sand about 9 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous loamy very fine sand. In places the surface layer is darker.

Typically, the Epping soil has a surface layer of light brownish gray, very friable silt loam about 4 inches thick. The underlying material extends to a depth of 16 inches. It is pale brown, calcareous silt loam. Brown siltstone bedrock is at a depth of about 16 inches. In some places the surface layer is very fine sandy loam or loam. In other places it is dark to a depth of 10 inches or more.

Included with these soils in mapping are small areas of Mitchell, Sarben, and Valent soils and outcrops of siltstone bedrock. Mitchell and Sarben soils are in landscape positions similar to those of the Otero and Epping soils. Mitchell soils have less sand than the Otero and Epping soils. Sarben soils are deeper to carbonates than the Otero and Epping soils. Valent soils are sandy and do not have carbonates. They are on dunes. The outcrops of siltstone bedrock are on the sides of deep gullies. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Otero soil and moderate in the Epping soil. The available water capacity is moderate in the Otero soil and low in the Epping soil. Runoff is rapid on the Otero soil and very rapid on the Epping soil. The organic matter content is low in both soils.

All of the acreage of these soils supports native grasses and is used for grazing. The soils are not suited to farming because of the slope.

If these soils are used as range, the climax vegetation in areas of the Otero soil is dominantly blue grama, little bluestem, prairie sandreed, threadleaf sedge, sand bluestem, and sideoats grama. These species make up 75 percent or more of the total annual forage on this soil. Needleandthread, western wheatgrass, and perennial grasses, sedges, and forbs make up the rest. The climax vegetation in areas of the Epping soil is dominantly blue grama, threadleaf sedge, needleandthread, little bluestem, and sideoats grama. These species make up 75 percent or more of the total annual forage on this soil. Buffalograss, western wheatgrass, prairie sandreed, and forbs make up the rest. If the Otero soil is subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If the Epping soil is subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable

Figure 10.—Typical landscape in an area of the Otero-Epping complex, 9 to 60 percent slopes.

to stabilize the site. As a result, water erosion and soil blowing are excessive and the less desirable woody plants may increase in abundance. In some areas brush management may be needed to control the woody plants that invade the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre on the Otero soil and 0.3 animal unit month per acre on the Epping soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

These soils are not suited to the trees and shrubs grown as windbreaks because of the slope and deep gullies.

These soils are generally not suited to septic tank absorption fields and dwellings because of the slope and the shallow depth to siltstone bedrock. Cutting and filling can provide a suitable grade for roads. Onsite investigation is needed to select a suitable alternative site.

The land capability unit is VIIe-5, dryland. The Otero soil is in the Sandy range site and windbreak suitability group 10. The Epping soil is in the Shallow Limy range site and windbreak suitability group 10.

RaG—Rock outcrop-Epping complex, 20 to 60 percent slopes. This map unit occurs as areas of sandstone outcrops and Epping soil on upland breaks. The areas are steep and very steep and somewhat excessively drained. The Rock outcrop is on the upper side slopes and ridgetops and on the upper part of dissected side slopes of breaks. The Epping soil is shallow and is on side slopes and narrow ridgetops. It formed in material that weathered from siltstone

bedrock. The areas range from 5 to more than 320 acres in size. They are 30 to 50 percent Rock outcrop and 30 to 50 percent Epping soil. They are so intricately mixed that separating them in mapping is not practical.

Typically, the Rock outcrop consists of white, calcareous sandstone bedrock. In places it is interbedded with siltstone bedrock and unconsolidated material.

Typically, the Epping soil has a surface layer of light yellowish brown, very friable, calcareous silt loam about 4 inches thick. The underlying material extends to a depth of 16 inches. It is light yellowish brown, calcareous silt loam. Light yellowish brown siltstone bedrock is at a depth of about 16 inches. In some places the soil has more sand. In other places sandstone bedrock is below a depth of 20 inches.

Included with this map unit are small areas of Bayard, Bridget, and Otero soils. These soils are deep. They are lower on the landscape than the Rock outcrop and Epping soil. Bayard and Otero soils have more sand throughout than the Epping soil. Bridget soils have a dark surface soil. Included soils make up 10 to 20 percent of the unit.

Permeability is moderate in the Epping soil, and the available water capacity is low. Runoff is rapid on the Epping soil and very rapid in areas of the Rock outcrop. The organic matter content is low in the Epping soil.

All of the acreage in this map unit supports native grasses and is used for grazing. The unit is not suited to farming because of the slope, the shallow rooting depth, and the Rock outcrop.

If this map unit is used as range, the climax vegetation in areas of the Epping soil is dominantly blue grama, threadleaf sedge, needleandthread, sideoats grama, and little bluestem. These species make up 70 percent or more of the total annual forage on this soil. Buffalograss, western wheatgrass, prairie sandreed, and forbs make up the rest. If subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, threadleaf sedge, and forbs. If overgrazing continues for many years, the less desirable woody plants may increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope can hinder the movement of livestock from one area to another. In some areas brush management may be needed to control the woody plants that invade the site.

The Epping soil generally is not suited to the trees and shrubs grown as windbreaks because of the slope and the shallow depth to bedrock.

The Epping soil generally is not suited to sanitary facilities and buildings because of the slope and the shallow depth to bedrock. A suitable alternative site should be selected. Cutting and filling can provide a suitable grade for roads.

The land capability unit is VIIs-3, dryland. The Epping soil is in the Shallow Limy range site and windbreak suitability group 10. The Rock outcrop is not assigned to a range site or windbreak suitability group.

RbB—Rosebud loam, 1 to 3 percent slopes. This moderately deep, very gently sloping, well drained soil formed in loamy material weathered from calcareous sandstone bedrock on uplands. Areas range from 7 to 120 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 7 inches thick. The subsoil is about 13 inches thick. It is grayish brown, friable clay loam in the upper part; brown, friable clay loam in the next part; and pale brown, friable clay loam in the lower part. The underlying material extends to a depth of 38 inches. It is very pale brown and pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 38 inches. In some places the surface soil is less than 7 inches thick. In other places the subsoil has less sand. In some areas calcareous sandstone bedrock is below a depth of 40 inches.

Included with this soil in mapping are small areas of Canyon soils. These soils are shallow over weakly cemented, calcareous sandstone bedrock. They are on low ridges and knolls. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Rosebud soil, and the available water capacity is moderate. Runoff is slow. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

Nearly all of the acreage of this soil is used for dryland farming. A few small areas are irrigated. The remaining acreage supports native grasses and is used for grazing.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are slight hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier to help protect the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue

to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are slight hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the underlying bedrock. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The main hazards are drought and soil blowing. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

A poor filtering capacity in this soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The soil generally is suited to dwellings and to small commercial buildings. The soft bedrock generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; windbreak suitability group 6R.

RcC—Rosebud-Canyon loams, 3 to 6 percent slopes. These soils are gently sloping and well drained. The Rosebud soil is moderately deep and is on side slopes and foot slopes in the uplands. The Canyon soil is shallow and is on narrow, convex ridges, on knolls, and on the upper part of side slopes. Both soils formed in loamy material weathered from calcareous sandstone bedrock. Areas range from 10 to 200 acres in size. They are 40 to 60 percent Rosebud soil and 25 to 45 percent Canyon soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Rosebud soil has a surface layer of grayish brown, very friable loam about 7 inches thick. The subsoil is about 18 inches thick. It is pale brown, friable clay loam in the upper part; very pale brown, very friable, calcareous loam in the next part; and white, very friable, calcareous very fine sandy loam in the lower part. The underlying material extends to a depth of 31 inches. It is very pale brown, calcareous sandy loam. Very pale brown, calcareous sandstone bedrock is at a depth of about 31 inches. In some places, all or most of the original surface layer has been removed by erosion and tillage has mixed the original surface layer with the subsoil. In these places the surface layer is lighter in color. In some areas it is calcareous. In other areas it is clay loam. In some places the calcareous sandstone bedrock is at a depth of more than 40 inches. In other places the subsoil has less clay.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 6 inches thick. Next is a transitional layer of light brownish gray, very friable, calcareous loam about 3 inches thick. The underlying material extends to a depth of 18 inches. It is pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 18 inches. Small fragments of sandstone are scattered throughout the profile. In some places, all or most of the original surface layer has been removed by erosion and tillage has mixed the original surface layer with the underlying material. In these places the surface layer is lighter in color and the depth to sandstone bedrock is less than 10 inches. In places rock outcrops are at the surface on ridgetops and the upper side slopes.

Included with these soils in mapping are small areas of Duroc, Keith, and Sidney soils. Duroc soils have a dark surface soil that is more than 20 inches thick. They are in swales and along drainageways. Keith soils have less sand in the subsoil than the Rosebud and Canyon soils. Sidney soils have more sand and less clay than the Rosebud soil. Keith and Sidney soils are in landscape positions similar to those of the Rosebud and Canyon soils. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Rosebud and Canyon soils. The available water capacity is moderate in the Rosebud soil and very low in the Canyon soil. Runoff is medium on both soils. The organic matter content is

moderate in the Rosebud soil and low in the Canyon soil. The water intake rate is moderate in both soils. Tilth is good, except for some areas of the Canyon soil where rock fragments are on the surface.

Nearly all of the acreage of these soils is farmed. Most areas are used for dryland farming, but some are irrigated. A few small areas support native grasses and are used for grazing.

If dry-farmed, these soils are suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, these soils are suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soils. Soil blowing and water erosion are the main hazards. A system of conservation tillage that keeps crop residue on the surface helps to control water erosion and soil blowing and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

The Rosebud soil is suited to the trees and shrubs grown as windbreaks. The moderate available water capacity is a limitation. The species selected for planting should be those that are tolerant of drought. Irrigation can provide the supplemental moisture needed during periods of low rainfall. The Canyon soil is not suited to the trees and shrubs grown as windbreaks because of the shallow rooting depth. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Rosebud soil is suited to septic tank absorption fields. The Canyon soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. A poor filtering capacity in the Rosebud soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. These soils are generally suited to dwellings and to small commercial buildings. The soft bedrock generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-1, dryland, and IVe-4, irrigated. The Rosebud soil is in the Silty range site and windbreak suitability group 6R. The Canyon soil is in the Shallow Limy range site and windbreak suitability group 10.

SaB—Sarben loamy very fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil formed in loamy eolian material. It is on stream terraces and valley side slopes. Areas range from 10 to 400 acres in size.

Typically, the surface layer is grayish brown, very friable loamy very fine sand about 5 inches thick. Next is a transitional layer of light brownish gray, very friable loamy very fine sand about 15 inches thick. The underlying material to a depth of 60 inches or more is loamy very fine sand. It is light brownish gray in the upper part and very pale brown and calcareous in the lower part. In some places the surface layer is darker. In other places it is thicker. In some areas it is loamy fine sand or fine sand. In other areas carbonates are at or near the surface.

Included with this soil in mapping are small areas of Valent soils. These soils have more sand than the Sarben soil. They are in landscape positions similar to those of the Sarben soil. They make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Sarben soil, and the available water capacity is moderate. Runoff is slow. The organic matter content is low. The water intake rate is high. Tilth is good.

Most of the acreage of this soil supports native grasses and is used as range. A few small areas are used for dryland farming or are irrigated.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to

control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, needleandthread, blue grama, little bluestem, and threadleaf sedge. These species make up 80 percent or more of the total annual forage. Sand bluestem, sand sagebrush, western wheatgrass, perennial grasses, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Undesirable weeds and grasses can be controlled by cultivation with conventional equipment and by applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields, dwellings, and roads. The sides of shallow excavations can cave in unless they are shored.

The land capability units are IVe-5, dryland, and IIIe-10, irrigated; Sandy range site; windbreak suitability group 5.

SaD—Sarben loamy very fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, well drained soil formed in loamy eolian material. It is on stream terraces and valley side slopes. Areas range from 10 to 400 acres in size.

Typically, the surface layer is brown, very friable loamy very fine sand about 7 inches thick. Next is a transitional layer of pale brown, very friable loamy very fine sand about 9 inches thick. The underlying material to a depth of 60 inches or more is very pale brown loamy very fine sand. It is calcareous below a depth of 29 inches. In some places the surface layer is darker. In other places it is thicker. In some areas it is loamy fine sand or very fine sandy loam. In other areas carbonates are at or near the surface.

Included with this soil in mapping are small areas of Bayard and Valent soils. These soils are in landscape positions similar to those of the Sarben soil. Bayard soils have a dark surface soil that is 10 to 20 inches thick. Valent soils have more sand than the Sarben soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Sarben soil, and the available water capacity is moderate. Runoff is medium. The organic matter content is low. The water intake rate is high. Tilth is good.

Most of the acreage of this soil supports native grasses and is used as range. A few small areas are used as cropland.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, needleandthread, blue grama, little bluestem, and threadleaf sedge. These species make up 80 percent or more of the total annual forage. Sand bluestem, sand sagebrush, western wheatgrass, perennial grasses, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in

abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields, dwellings, and roads. The sides of shallow excavations can cave in unless they are shored.

The land capability units are IVe-5, dryland, and IVe-10, irrigated; Sandy range site; windbreak suitability group 5.

StB—Satanta fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loamy eolian material on slightly convex ridgetops and broad upland divides. Areas range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsoil is about 20 inches thick. It is brown and pale brown, firm sandy clay loam in the upper part and pale brown, calcareous, friable loam in the lower part. The underlying material extends to a depth of 60 inches or more. It is very pale brown, calcareous fine sandy loam in the upper part and pale brown, calcareous loamy fine sand in the lower part. In some places the dark surface soil is more than 20 inches thick. In other places the surface layer is loam or sandy loam. In some areas gravelly loamy coarse sand is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Alliance, Creighton, and Keith soils. Alliance and Keith soils are in landscape positions similar to those of the Satanta soil. They have less sand in the subsoil than the Satanta soil. Alliance soils are 40 to 60 inches deep over sandstone bedrock. Creighton soils have less clay in the subsoil than the Satanta soil. Also, they are higher on the landscape. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Satanta soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderately low. The water intake rate is moderate. Tilth is good.

Most of the acreage of this soil is used for dryland farming. The rest supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the sandy underlying material. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in a severe hazard of soil blowing. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture

needed during periods of low rainfall. Undesirable weeds and grasses can be controlled by cultivation with conventional equipment and by applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-5, irrigated; Silty range site; windbreak suitability group 5.

SvC—Satanta-Altvan complex, 3 to 6 percent slopes. These soils are well drained and gently sloping. The Satanta soil is deep and is on side slopes in the uplands. It formed in loamy eolian sediments. The Altvan soil is moderately deep over gravelly coarse sand and is on convex summits and side slopes in the uplands. It formed in loamy sediments. Areas range from 20 to several hundred acres in size. They are 55 to 75 percent Satanta soil and 15 to 25 percent Altvan soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Satanta soil has a surface layer of grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 17 inches thick. It is brown, firm sandy clay loam in the upper part and pale brown, very friable loam in the lower part. The underlying material to a depth of 60 inches or more is fine sandy loam. It is light yellowish brown in the upper part and very pale brown and calcareous in the lower part. In some places the subsoil has less clay. In other places the surface layer is very fine sandy loam or sandy loam.

Typically the Altvan soil has a surface layer of grayish brown, very friable loam about 7 inches thick. The subsoil is firm sandy clay loam about 15 inches thick. It is brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches or more is very pale brown and calcareous. It is coarse sand in the upper part and gravelly coarse sand in the lower part. In some places the surface layer is sandy loam, fine sandy loam, or very fine sandy loam.

Included with these soils in mapping are small areas of Creighton, Eckley, and Vetal soils. Creighton soils are in landscape positions similar to those of the Satanta and Altvan soils. Also, they have less clay in the subsoil than the Satanta and Altvan soils. Eckley soils are shallow over very gravelly sand. They are on knolls. Vetal soils have a dark surface soil that is more than 20 inches thick. They are in low swales or on foot slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Satanta soil and moderate to very rapid in the Altvan soil. The available water capacity is high in the Satanta soil and moderate in the Altvan soil. Runoff is medium on both soils. The organic matter content is moderately low. The water intake rate is moderate. Tilth is good.

Most of the acreage of these soils are farmed. Most areas are dryland farmed, but a few small areas are irrigated. The remaining acreage supports native grasses and is used as range.

If dry-farmed, these soils are suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, these soils are suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soils. Soil blowing and water erosion are hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

These soils are suited to the trees and shrubs grown as windbreaks. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Satanta soil is suited to septic tank absorption fields. The Altvan soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations in the Altvan soil can cave in unless they are shored. The damage to roads caused by frost

action in areas of these soils can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIIe-5, irrigated. The Satanta soil is in the Silty range site and windbreak suitability group 5. The Altvan soil is in the Silty range site and windbreak suitability group 6G.

SxC—Sidney-Canyon loams, 3 to 6 percent slopes. These soils are gently sloping and well drained. The Sidney soil is deep and is on side slopes in the uplands. It formed in calcareous, loamy material. The Canyon soil is shallow over sandstone bedrock and is on narrow, convex ridges, on knolls, and on the upper part of side slopes. It formed in calcareous, loamy material weathered from sandstone bedrock. Areas range from 10 to 200 acres in size. They are 40 to 60 percent Sidney soil and 25 to 45 percent Canyon soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Sidney soil has a surface layer of grayish brown, very friable, calcareous loam about 7 inches thick. The subsoil is about 19 inches thick. It is brown, very friable, calcareous very fine sandy loam in the upper part and light brownish gray, very friable, calcareous silt loam in the lower part. The underlying material extends to a depth of 48 inches. It is very pale brown, calcareous very fine sandy loam. White, calcareous sandstone bedrock is at a depth of about 48 inches. In some places, most or all of the original surface soil has been removed by erosion and tillage has mixed the remaining surface soil with the subsoil. In these places the surface layer is lighter in color. In some areas the surface soil is thicker.

Typically, the Canyon soil has a surface layer of brown, very friable, calcareous loam about 4 inches thick. The underlying material extends to a depth of 11 inches. It is very pale brown, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 11 inches. Small sandstone fragments are scattered throughout the profile. In some places the depth to sandstone bedrock is less than 10 inches. In other places, the original dark surface soil has been removed by erosion and tillage has mixed the remaining surface soil with the underlying material. In these places the surface layer is lighter in color. In some areas numerous sandstone fragments are on the surface.

Included with these soils in mapping are small areas of Duroc and Rosebud soils. Duroc soils are deep. They have a dark surface soil that is more than 20 inches thick. They are lower on the landscape than the Sidney and Canyon soils. Rosebud soils are moderately deep. They are in landscape positions similar to those of the Sidney and Canyon soils. Also, they have more clay in the subsoil than the Sidney and Canyon soils. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Sidney and Canyon soils. The available water capacity is high in the Sidney soil and very low in the Canyon soil. Runoff is medium on both soils. The organic matter content is moderate in the Sidney soil and low in the Canyon soil. The water intake rate is moderate in both soils.

Most of the acreage of these soils is used for dryland farming. A few areas are irrigated.

If dry-farmed, these soils are suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, these soils are suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soils. Soil blowing and water erosion are the main hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

The Sidney soil is suited to the trees and shrubs grown as windbreaks. The Canyon soil is not suited to the trees and shrubs grown as windbreaks because of the shallow depth to bedrock and the very low available water capacity. Soil blowing in areas of the Sidney soil can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Sidney soil is suited to septic tank absorption fields. A poor filtering capacity in this soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The moderate permeability in the Sidney soil is an additional limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The Canyon soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. A suitable alternative site should be selected. The soft bedrock in areas of these soils generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations. Strengthening the foundations of buildings and backfilling with coarse material help to prevent the damage caused by shrinking and swelling. Cutting and filling can provide a suitable grade for roads. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage in areas of the Sidney soil.

The land capability units are IVe-1, dryland, and IIIe-6, irrigated. The Sidney soil is in the Silty range site and windbreak suitability group 3. The Canyon soil is in the Shallow Limy range site and windbreak suitability group 10.

SxD—Sidney-Canyon loams, 6 to 9 percent slopes. These soils are strongly sloping and well drained. The Sidney soil is deep and is on side slopes and ridgetops in the uplands. It formed in calcareous, loamy material. The Canyon soil is shallow and is on narrow ridgetops and the convex shoulders of dissected side slopes. It formed in calcareous, loamy material weathered from sandstone bedrock. Areas range from 10 to 200 acres in size. They are 40 to 60 percent Sidney soil and 25 to 45 percent Canyon soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical.

Typically, the Sidney soil has a surface layer of grayish brown, very friable loam about 7 inches thick. The subsoil is about 20 inches thick. It is light brownish gray, very friable, calcareous very fine sandy loam in the upper part and light gray, very friable, calcareous loam in the lower part. The underlying material extends to a depth of 44 inches. It is very pale brown, calcareous sandy loam. White, calcareous sandstone bedrock is at a depth of about 44 inches. In some places the subsoil and underlying material have more fine sand. In other places the surface soil is dark to a depth of more than 20 inches. In some areas gravelly coarse sand is at a depth of 40 to 60 inches.

Typically, the Canyon soil has a surface layer of grayish brown, very friable loam about 6 inches thick. Next is a transitional layer of light brownish gray, very friable, calcareous loam about 5 inches thick. The underlying material extends to a depth of 14 inches. It is light gray, calcareous loam. White, calcareous sandstone bedrock is at a depth of about 14 inches. In some places sandstone bedrock is at a depth of less than 10 inches. In other places the loamy material overlying the bedrock has less clay and more sand.

Included with these soils in mapping are small areas of Duroc and Eckley soils. Duroc soils are deep. They are in swales and along drainageways. They have a surface soil that is more than 20 inches thick. Eckley soils have gravelly coarse sand at a depth of 10 to 20 inches. They are on convex side slopes and shoulders of ridgetops. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Sidney and Canyon soils. The available water capacity is high in the Sidney soil and very low in the Canyon soil. Runoff is medium on both soils. The organic matter content is moderate in the Sidney soil and low in the Canyon soil. The water intake rate is moderate in both soils.

Most of the acreage of these soils is used as range. A few small areas are used as cropland.

If dry-farmed, these soils are suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, these soils are suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soils. Soil blowing and water erosion are severe hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion.

If these soils are used as range, the climax vegetation in areas of the Sidney soil is dominantly western wheatgrass, needleandthread, and blue grama. These species make up 70 percent or more of the total annual forage on this soil. Sedges, buffalograss, annual grasses, and forbs make up the rest. The climax vegetation in areas of the Canyon soil is dominantly little bluestem, threadleaf sedge, sideoats grama, and blue grama. These species make up 55 percent or more of the total annual forage on this soil.

Needleandthread, hairy grama, big bluestem, western wheatgrass, plains muhly, annual grasses, and forbs make up the rest. If the Sidney soil is subject to continuous heavy grazing, big bluestem, little bluestem, prairie junegrass, and switchgrass decrease in abundance and are replaced by blue grama, buffalograss, needleandthread, plains muhly, sand dropseed, tall dropseed, western wheatgrass, and forbs. If the Canyon soil is subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive in areas of the Sidney soil. Woody plants may increase in abundance in areas of the Canyon soil.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre on the Sidney soil and 0.3 animal unit month per acre on the Canyon soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

The Sidney soil is suited to the trees and shrubs grown as windbreaks. The Canyon soil is not suited to the trees and shrubs grown as windbreaks because of the shallow rooting depth. Soil blowing in areas of the Sidney soil can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Sidney soil is suited to septic tank absorption fields. A poor filtering capacity in this soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The moderate permeability is an additional limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The Canyon soil generally is not suited to septic tank absorption fields because of the shallow depth to bedrock. A suitable alternative site should be selected. Dwellings in areas of these soils should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The soft bedrock generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations. Strengthening the foundations of buildings and backfilling with coarse material help to prevent the damage caused by shrinking and swelling. Cutting and filling can provide a suitable grade for roads. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage in areas of the Sidney soil.

The land capability units are IVe-1, dryland, and IVe-6, irrigated. The Sidney soil is in the Silty range site and windbreak suitability group 3. The Canyon soil is in the Shallow Limy range site and windbreak suitability group 10.

SxD2—Sidney-Canyon loams, 6 to 9 percent slopes, eroded. These soils are strongly sloping and well drained. The Sidney soil is deep and is on side slopes and summits in the uplands. It formed in calcareous, loamy material. The Canyon soil is shallow and is on narrow ridgetops and the convex shoulders of side slopes. It formed in calcareous, loamy material weathered from sandstone bedrock. Areas range from 10 to 200 acres in size. They are 40 to 60 percent Sidney soil and 25 to 45 percent Canyon soil. These two soils occur as areas so intricately mixed that separating them in mapping is not practical (fig. 11). In most areas of these soils, all or most of the original dark surface soil has been removed by erosion and tillage has mixed the remaining surface soil with the upper part of the subsoil.

Typically, the Sidney soil has a surface layer of grayish brown, very friable, calcareous loam about 6 inches thick. The subsoil is calcareous very fine sandy loam about 13 inches thick. It is brown and very friable in the upper part and pale brown in the lower part. The underlying material extends to a depth of 48 inches. It is pale brown, calcareous sandy loam. White, calcareous sandstone bedrock is at a depth of about 48 inches. In some places the subsoil has more fine sand. In other places the surface soil is more than 20 inches thick. In some areas calcareous sandstone bedrock is at a depth of less than 40 inches. In other areas gravelly coarse sand is at a depth of 40 to 60 inches.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 6 inches thick. The subsurface layer is light brownish gray, very friable, calcareous loam about 4 inches thick. The underlying material extends to a depth of 13 inches. It is light gray, calcareous sandy loam. White, calcareous sandstone bedrock is at a depth of about 13

Figure 11.—Typical landscape in an area of the Sidney-Canyon loams, 6 to 9 percent slopes, eroded. The Canyon soil is in the light-colored areas, and the Sidney soil is in the dark areas.

inches. In some places sandstone bedrock is at a depth of less than 10 inches. In other places the loamy material has less clay.

Included with these soils in mapping are small areas of Duroc and Eckley soils. Duroc soils have a surface soil that is more than 20 inches thick. They have more clay than the Sidney and Canyon soils. They are in swales and along drainageways. Eckley soils have very gravelly sand at a depth of 10 and 20 inches. They are on convex side slopes and ridgetops. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Sidney and Canyon soils. The available water capacity is high in the Sidney soil and very low in the Canyon soil. Runoff is medium on both soils. The organic matter content is moderately low in the Sidney soil and low in the Canyon soil. The water intake rate is moderate in both soils.

Nearly all of the acreage of these soils are farmed. A few small areas are irrigated.

If dry-farmed, these soils are suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, these soils are suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded areas of cropland.

The Sidney soil is suited to the trees and shrubs grown as windbreaks. The Canyon soil is not suited to the trees and shrubs grown as windbreaks because of the shallow rooting depth. The main hazards in areas of the Sidney soil are soil blowing, drought, and water erosion. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The Sidney soil is suited to septic tank absorption fields. A poor filtering capacity in this soil is a limitation on sites for septic tank absorption fields. This limitation can be overcome by building up or mounding the site with suitable fill material. The moderate permeability in the Sidney soil is an additional limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The Canyon soil generally is not suited to septic tank absorption fields. A suitable alternative site should be selected. Dwellings constructed in areas of these soils should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. The soft bedrock generally can be easily excavated during the construction of houses with basements or buildings that have deep foundations. Strengthening the foundations of buildings and backfilling with coarse material help to prevent the damage caused by shrinking and swelling. Cutting and filling can provide a suitable grade for roads. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage in areas of the Sidney soil.

The land capability units are IVe-8, dryland, and IVe-6, irrigated. The Sidney soil is in the Silty range site and windbreak suitability group 3. The Canyon soil is in the Shallow Limy range site and windbreak suitability group 10.

TcG—Tassel-Busher-Rock outcrop complex, 20 to 60 percent slopes. This map unit occurs as areas of steep and very steep, somewhat excessively drained soils intermingled with areas of Rock outcrop. The Tassel soil is shallow and is on ridgetops and upper side slopes in the uplands. The Busher soil is deep and is on the mid and lower side slopes in the uplands. These soils formed in sandy and loamy material weathered from sandstone bedrock. The Rock outcrop is on ridgetops and shoulder slopes in the uplands. Areas of this unit range from 50 to 240 acres in size. They are 40 to 60 percent Tassel soil, 20 to 30 percent Busher soil, and 10 to 20 percent Rock outcrop. The two soils and the areas of Rock outcrop are so intricately mixed that separating them in mapping is not practical.

Typically, the Tassel soil has a surface layer of pale brown, very friable, calcareous loamy very fine sand about 9 inches thick. The underlying material extends to a depth of 16 inches. It is pale brown, calcareous loamy very fine sand. White, calcareous sandstone bedrock is at a depth of about 16 inches. In some places the soil is finer textured. In other places the surface layer is darker.

Typically, the Busher soil has a surface layer of brown, very friable loamy very fine sand about 9 inches thick. The subsoil is pale brown, very friable loamy very fine sand about 7 inches thick. The underlying material extends to a depth of 48 inches. It is brown, calcareous loamy very fine sand. White, calcareous sandstone bedrock is at a depth of about 48 inches. In some places the surface layer is very fine sandy loam. In other places it is pale brown. In some areas very gravelly coarse sand is at a depth of 40 inches or more.

Typically, the Rock outcrop is fine grained, calcareous sandstone bedrock. Thin to thick layers of strongly cemented sandstone bedrock alternate with layers of weakly cemented sandstone bedrock. Outcrops of siltstone bedrock are lower on the landscape in places.

Included in this unit in mapping are small areas of Bridget and Eckley soils. Bridget soils have less sand than the Tassel and Busher soils. They do not have sandstone bedrock at a depth of 60 inches. They are on foot slopes. Eckley soils are shallow over very gravelly sand. They are on narrow ridgetops. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Tassel and Busher soils. Runoff is rapid on the Tassel and Busher soils and very rapid in areas of the Rock outcrop. The available water capacity is very low in the Tassel soil and moderate in the Busher soil. The organic matter content is low in the Tassel soil and moderately low in the Busher soil.

All of the acreage in this map unit supports native grasses and is used mainly as range. The native grasses are interspersed with trees (fig. 12). The unit is not suited to farming because of the slope, the shallow root zone in areas of the Tassel soil, and the Rock outcrop.

If this map unit is used as range, the climax vegetation in areas of the Tassel soil is dominantly blue grama, little bluestem, threadleaf sedge, and

Figure 12.—An area of the Tassel-Busher-Rock outcrop complex, 20 to 60 percent slopes, that provides habitat for wildlife.

needleandthread. These species make up 60 percent or more of the total annual forage. Prairie sandreed, sand bluestem, sideoats grama, plains muhly, and forbs make up the rest. The climax vegetation in areas of the Busher soil is dominantly blue grama, little bluestem, threadleaf sedge, and needleandthread. These species make up 60 percent or more of the total annual forage. Prairie sandreed, sand bluestem, sideoats grama, plains muhly, other perennial grasses, forbs, and shrubs make up the rest. Ponderosa pine covers 5 to 15 percent of the area. If the Tassel soil is subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If the Busher soil is subject to continuous heavy grazing, big bluestem, little bluestem, and sideoats grama decrease in abundance and are replaced by hairy grama, bluegrass, needleandthread, prairie sandreed, and slender wheatgrass. If overgrazing continues for many years, the woody plants increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre on both the Tassel and Busher soils. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope can hinder the movement of livestock from one area to another.

This map unit generally is not suited to the trees and shrubs grown as windbreaks because of the slope, the Rock outcrop, and the shallow rooting depth.

This map unit generally is not suited to septic absorption fields because of the shallow depth to bedrock and the slope. A suitable alternative site should be selected. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. Cutting and filling can provide a suitable grade for roads. The soft bedrock can be excavated during the construction of roads.

The land capability unit is VIIs-4, dryland. The Tassel soil is in the Shallow Limy range site and windbreak suitability group 10. The Busher soil is in the Savannah range site and windbreak suitability group 10. The Rock outcrop is not assigned a range site or a windbreak suitability group.

TfG—Tassel-Rock outcrop complex, 20 to 60 percent slopes. This map unit occurs as areas of a steep and very steep, somewhat excessively drained Tassel soil intermingled with areas of Rock outcrop. The Tassel soil is shallow and is on breaks and side slopes in the uplands. It formed in sandy and loamy material weathered from sandstone bedrock. The Rock outcrop is on ridgetops and the upper part of side slopes. Areas of the unit range from 40 to more than 640 acres in size. They are 50 to 65 percent Tassel soil and 25 to 35 percent Rock outcrop. The Tassel soil and the areas of Rock outcrop are so intricately mixed that separating them in mapping is not practical.

Typically, the surface layer of the Tassel soil is pale brown, very friable, calcareous loamy very fine sand about 7 inches thick. The underlying material extends to a depth of 15 inches. It is pale brown, calcareous loamy very fine sand. White, calcareous sandstone bedrock is at a depth of about 15 inches. In some places the soil is finer textured. In other places sandstone bedrock is at a depth of less than 10 inches.

Typically, the Rock outcrop is fine grained, calcareous sandstone bedrock. Thin to thick layers of strongly cemented sandstone bedrock alternate with layers of weakly cemented sandstone bedrock. Outcrops of siltstone bedrock are lower on the landscape in places.

Included in this unit in mapping are small areas of Busher, Eckley, and Otero soils. Busher soils are deep. They have a thicker surface soil than that of the Tassel soil. They are on convex side slopes. Eckley soils are shallow over very gravelly sand. They are in landscape positions similar to those of the Tassel soil. Otero soils are deep. They are on foot slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Tassel soil, and the available water capacity is very low. Runoff is rapid on the Tassel soil and very rapid in areas of the Rock outcrop. The organic matter content is low in the Tassel soil.

All of the acreage in this map unit is used as range. The unit is not suited to farming because of the slope, the shallow rooting depth, and the Rock outcrop.

If this map unit is used as range, the climax vegetation in areas of the Tassel soil is dominantly blue grama, little bluestem, threadleaf sedge, and needleandthread. These species make up 60 percent or more of the total annual forage. Prairie sandreed, sand bluestem, sideoats grama, plains muhly, and forbs make up the rest. If the Tassel soil is subject to continuous heavy grazing, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If overgrazing continues for many years, the less desirable woody plants may increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.3 animal unit month per acre on the Tassel soil. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The slope can hinder the movement of livestock from one area to another. In some areas brush management may be needed to control the woody plants that invade the site.

This map unit generally is not suited to the trees and shrubs grown as windbreaks because of the slope, the Rock outcrop, and the shallow rooting depth.

This map unit generally is not suited to septic absorption fields because of the shallow depth to bedrock and the slope. A suitable alternative site should be selected. Dwellings should be designed so that they conform to the natural slope of the land, or building sites should be graded to a suitable gradient. Cutting and filling can provide a suitable grade for roads. The soft bedrock can be excavated during the construction of roads.

The land capability unit is VIIs-4, dryland. The Tassel soil is in the Shallow Limy range site and windbreak suitability group 10. The Rock outcrop is not assigned a range site or a windbreak suitability group.

ToB—Tripp loamy very fine sand, overblown, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil formed in alluvium that has been reworked by the wind on stream terraces.

Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable loamy very fine sand about 9 inches thick. The subsurface layer is pale brown, very friable loamy very fine sand about 7 inches thick. Next is a buried surface layer of grayish brown very fine sandy loam about 14 inches thick. The subsoil is very fine sandy loam about 24 inches thick. It is pale brown in the upper part and light gray and calcareous in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface layer is loamy fine sand, fine sandy loam, or very fine sandy loam. In other places it is lighter in color. In some areas the sandy overblown material is more than 20 or less than 10 inches thick.

Included with this soil in mapping are small areas of Alice and Sarben soils. These soils are in landscape positions similar to those of the Tripp soil. Also, they have more sand in the subsoil than the Tripp soil. Sarben soils do not have a dark surface soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Tripp soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderately low. The water intake rate is high. Tilth is good.

Most of the acreage of this soil is used for farming. The rest supports native grasses and is used as range. Some areas are irrigated.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Weeds and grasses can be controlled by cultivation with conventional equipment and by applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. This soil generally is suited to dwellings. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-5, dryland, and IIIe-10, irrigated; Sandy range site; windbreak suitability group 5.

ToC—Tripp loamy very fine sand, overblown, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in alluvium that has been reworked by the wind on stream terraces. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable loamy very fine sand about 7 inches thick. The subsurface layer is pale brown, very friable loamy very fine sand about 7 inches thick. Next is a buried surface layer of grayish brown and brown very fine sandy loam about 14 inches thick. The subsoil is about 22 inches thick. It is pale brown, very fine sandy loam in the upper part and light gray, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface layer is loamy fine sand, fine sandy loam, or very fine sandy loam. In other places it is lighter in color. In some areas the sandy overblown material is more than 20 or less than 10 inches thick.

Included with this soil in mapping are small areas of Alice and Sarben soils. These soils are in landscape positions similar to those of the Tripp soil. Also, they have more sand in the subsoil than the Tripp soil. Sarben soils do not have a dark surface soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Tripp soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderately low. The water intake rate is high. Tilth is good.

Most of the acreage of this soil is used for farming.

The rest supports native grasses and is used as range. Some areas are irrigated.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Terracing helps to reduce the runoff rate and control water erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by sprinkler irrigation systems. Soil blowing and water erosion are the main hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. This soil generally is suited to dwellings. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-5, dryland, and IVe-10, irrigated; Sandy range site; windbreak suitability group 5.

Tr—Tripp very fine sandy loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in loamy alluvium and loess on high stream terraces. Areas range from 5 to 350 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 7 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 4 inches thick. The subsoil is about 17 inches thick. It is pale brown, very friable very fine sandy loam in the upper part and very pale brown, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface soil is more than 20 inches thick. In other places the subsoil does not have a layer of carbonates. In some areas the surface layer is lighter in color.

Included with this soil in mapping are small areas of Alice soils. These soils are in landscape positions similar to those of the Tripp soil. Also, they have more sand in the subsoil than the Tripp soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Tripp soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

Most of the acreage of this soil is used for dryland farming. Some areas are irrigated.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and drought are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing is a hazard. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows.

Irrigation can supply the moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIc-1, dryland, and IIe-6, irrigated; Silty range site; windbreak suitability group 3.

TrB—Tripp very fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loamy alluvium and loess on high stream terraces. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 7 inches thick. The subsurface layer is brown, very friable very fine sandy loam about 5 inches thick. The subsoil is about 18 inches thick. It is pale brown, very friable very fine sandy loam in the upper part and light gray, very friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some places the surface soil is more than 20 inches thick. In other places it is lighter in color. In some areas the subsoil has more clay.

Included with this soil in mapping are small areas of Alice soils. These soils are in landscape positions similar to those of the Tripp soil. Also, they have more sand in the subsoil than the Tripp soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Tripp soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

Most of the acreage of this soil is used for farming. The rest supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-6, irrigated; Silty range site; windbreak suitability group 3.

TrC—Tripp very fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loamy alluvium and loess on high stream terraces. Areas range from 5 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer also is grayish brown, very friable very fine sand loam. It is about 3 inches thick. The subsoil is about 26 inches thick. It is light brownish gray, very friable very fine sandy loam in the upper part and very pale brown, very friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some cultivated areas, most or all of the original surface layer has been removed by erosion and tillage has mixed the original surface soil with the subsoil. In these areas the surface layer is lighter in color. In some places it is calcareous. In other places

the surface soil is more than 20 inches thick.

Included with this soil in mapping are small areas of Alice soils. These soils are in landscape positions similar to those of the Tripp soil. Also, they have more sand in the subsoil than the Tripp soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Tripp soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

Much of the acreage of this soil is used for dryland or irrigated crops. Some areas support native grasses and are used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Overgrazing also can result in the severe hazards of soil blowing and water erosion. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to dwellings. The moderate permeability is a limitation on sites for septic tank absorption fields. It generally can be overcome by increasing the size of the field. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIIe-6, irrigated; Silty range site; windbreak suitability group 3.

TrD—Tripp very fine sandy loam, 6 to 9 percent slopes. This deep, strongly sloping, well drained soil is on high stream terraces. It formed in loamy alluvium and loess. Areas range from 6 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The subsoil is about 34 inches thick. It is brown, very friable very fine sandy loam in the upper part; pale brown, very friable very fine sandy loam in the next part; and light gray, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous very fine sandy loam. In some cultivated areas, all or most of the original surface soil has been removed by erosion and tillage has mixed the original surface soil with the subsoil. In these areas the surface layer is lighter in color. In places it is calcareous.

Included with this soil in mapping are small areas of Bayard and Dix soils. Bayard soils have more fine sand than the Tripp soil. They are on foot slopes. Dix soils are shallow over very gravelly coarse sand. They are in landscape positions similar to those of the Tripp soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Tripp soil, and the available water capacity is high. Runoff is medium. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

Most areas of this soil support native grasses and are used for grazing. Some are used for dryland farming.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are severe hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soi moisture. Terracing helps to reduce the runoff rate and control erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by sprinkler irrigation systems. Soil blowing

and water erosion are severe hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion.

In the areas used as range, the climax vegetation is dominantly needleandthread, threadleaf sedge, blue grama, and western wheatgrass. These species make up 70 percent or more of the total annual forage. Little bluestem, buffalograss, big bluestem, prairie junegrass, sideoats grama, green needlegrass, plains muhly, sand dropseed, Sandberg bluegrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, and prairie junegrass decrease in abundance and are replaced by blue grama, buffalograss, needleandthread, plains muhly, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are severe hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-3, dryland, and IVe-6, irrigated; Silty range site; windbreak suitability group 3.

VaD—Valent fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil formed in sandy eolian material on uplands. Areas range from 5 to 200 acres in size.

Typically, the surface layer is brown, loose fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand. In some places the surface layer is darker. In other places carbonates are at a depth of less than 40 inches.

Included with this soil in mapping are small areas of Sarben and Tassel soils. Sarben soils are in landscape positions similar to those of the Valent soil. Also, they have more silt throughout than the Valent soil. They are well drained. Tassel soils are shallow over sandstone bedrock. They are generally higher on the landscape than the Valent soil. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Valent soil, and the available water capacity is low. Runoff is slow. The organic matter content is low. The water intake rate is very high.

Most of the acreage of this soil supports native grasses and is used as range. A few small areas are irrigated. The soil generally is not suited to dryland farming because of the severe hazards of soil blowing and drought.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. A sprinkler system is the only method of irrigation suited to the soil. Soil blowing and water erosion are severe hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion. Careful management of water is needed to prevent leaching of plant nutrients and pesticides below the plant roots. Applying barnyard manure increases the content of organic matter and improves fertility.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, little bluestem, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, sand dropseed, switchgrass, sand lovegrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by

maintaining strips of sod or other vegetation between the tree rows. Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the soil as possible. Irrigation can supply the moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are shored. The soil generally is suited to dwellings and roads.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sands range site; windbreak suitability group 7.

VaE—Valent fine sand, rolling. This deep, excessively drained soil formed in sandy eolian material on dunes. Slopes range from 9 to 24 percent. Areas range from 5 to more than 640 acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 3 inches thick. The underlying material is loose fine sand to a depth 60 inches or more. It is grayish brown in the upper part and pale brown in the lower part. In some places carbonates are at a depth of less than 40 inches. In other places the surface layer is darker. In some areas the soil has less sand and more silt.

Included with this soil in mapping are small areas of Sarben and Tassel soils. Sarben soils have more silt throughout than the Valent soil. They are well drained. They are in landscape positions similar to those of the Valent soil. Tassel soils are shallow over sandstone bedrock. They are higher on the landscape than the Valent soil. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Valent soil, and the available water capacity is low. Runoff is slow. The organic matter content is low.

This soil supports native grasses and is used as range. It is not suited to farming because of the slope and a severe hazard of soil blowing.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, little bluestem, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, sand dropseed, switchgrass, sand lovegrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are severe hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the soil as possible. Irrigation can supply the supplemental moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are shored. The soil generally is suited to dwellings and roads.

The land capability unit is VIe-5, dryland; Sands range site; windbreak suitability group 7.

VdB—Valent loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, excessively drained soil formed in sandy eolian material on uplands. Areas range from 5 to 200 acres in size.

Typically, the surface layer is dark brown, very friable loamy fine sand about 7 inches thick. Next is a transitional layer of pale brown, loose fine sand about 9 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand. In some places carbonates are at a depth of less than 40 inches. In other places the surface layer is darker. In some areas a buried loamy layer is at a depth of 30 to 60 inches.

Included with this soil in mapping are small areas of Sarben and Vetal soils. Sarben soils are in landscape positions similar to those of the Valent soil. Also, they have more silt than the Valent soil. Vetal soils have a surface soil that is more than 20 inches thick. They have less sand than the Valent soil. Also, they are lower on the landscape. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Valent soil, and the

available water capacity is low. Runoff is slow. The organic matter content is low. The water intake rate is very high.

Most of the acreage of this soil supports native grasses and is used as range. Some areas are used for irrigated cropland. The soil generally is not suited to dryland farming because of the hazards of soil blowing and drought.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. It is too sandy for gravity irrigation systems. Soil blowing is a hazard. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Careful management of water is needed to prevent leaching of plant nutrients and pesticides below the plant roots. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing. Applying barnyard manure increases the content of organic matter and improves fertility.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, blue grama, needleandthread, little bluestem, and threadleaf sedge. These species make up 75 percent or more of the total annual forage. Sand bluestem, sand dropseed, perennial grasses, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the soil as possible. Irrigation can supply the moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are shored. The soil generally is suited to dwellings and roads.

The land capability units are VIe-5, dryland, and IVe-11, irrigated; Sandy range site; windbreak suitability group 7.

VdD—Valent loamy fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil formed in sandy eolian material on uplands. Areas range from 10 to 400 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 4 inches thick. Next is a transitional layer of light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray, loose fine sand. In some places carbonates are at a depth of less than 40 inches. In other places the surface layer is darker and thicker.

Included with this soil in mapping are small areas of Sarben and Vetal soils. Sarben soils are in landscape positions similar to those of the Valent soil. Also, they have more silt than the Valent soil. Vetal soils have a surface soil that is more than 20 inches thick. They have less sand than the Valent soil. They are on the concave, lower slopes. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Valent soil, and the available water capacity is low. Runoff is slow. The organic matter content is low. The water intake rate is very high.

Most of the acreage of this soil supports native grasses and is used for grazing. A few small areas are farmed and irrigated. The soil generally is not suited to dryland farming because of the hazards of soil blowing, water erosion, and drought.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. It is too sandy for gravity irrigation systems. Soil blowing and water erosion are severe hazards. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Careful management of water is needed to prevent leaching of plant nutrients and pesticides below the plant roots. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

In the areas used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, little

bluestem, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, sand dropseed, switchgrass, sand lovegrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Because the soil is loose, trees should be planted in shallow furrows with as little disturbance of the soil as possible. Irrigation can supply the moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of appropriate herbicide.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. The sides of shallow excavations can cave in unless they are shored. The soil generally is suited to dwellings and roads.

The land capability units are VIe-5, dryland, and IVe-11, irrigated; Sands range site; windbreak suitability group 7.

VnC—Vetal fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil formed in loamy and sandy sediments in swales. It is on foot slopes. Areas range from 20 to several hundred acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsurface layer also is dark grayish brown, very friable fine sandy loam about 7 inches thick. Next is a transitional layer of grayish brown, very friable fine sandy loam about 22 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sandy loam. In some places carbonates are at a depth of less than 30 inches. In other places the transitional layer has more clay. In some areas the surface layer is very fine sandy loam or loam.

Included with this soil in mapping are small areas of Satanta soils. These soils have a dark surface soil that is less than 20 inches thick. They are in landscape positions similar to those of the Vetal soil. Also, they have more clay than the Vetal soil. They make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Vetal soil, and the available water capacity is moderate. Runoff is slow. The organic matter content is moderate. The water intake rate is moderately high. Tilth is good.

Most of the acreage of this soil is used for dryland farming. The rest supports native grasses and is used as range.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Terracing helps to reduce the runoff rate and control water erosion. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Sprinkler irrigation systems are best suited to the soil. Soil blowing and water erosion are hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion. Returning crop residue to the soil and minimizing tillage help to control erosion and maintain fertility. Protecting the surface with cover crops or crop residue during the winter helps to control soil blowing and water erosion. Applying barnyard manure increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing, drought, and water erosion are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Planting the trees on the contour and terracing reduce the runoff rate and help to

control water erosion. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The damage to roads by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-3, dryland, and IIIe-8, irrigated; Sandy range site; windbreak suitability group 5.

VtB—Vetal very fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil formed in loamy and sandy sediments in swales. It is on valley fans and foot slopes. Areas range from 40 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 25 inches thick. Next is a transitional layer of light brownish gray, very friable very fine sandy loam about 10 inches thick. The underlying material to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In some places carbonates are at a depth of less than 30 inches. In other places the surface layer is lighter in color. In a few areas the soil is loamy very fine sand or fine sandy loam. In other areas a buried soil is at a depth of 24 to 60 inches.

Included with this soil in mapping are small areas of Otero, Sarben, and Valent soils. These soils have a thinner and lighter colored surface soil than that of the Vetal soil. Sarben and Valent soils have more fine sand than the Vetal soil. Also, they are higher on the landscape. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Vetal soil, and the available water capacity is high. Runoff is slow. The organic matter content is moderate. The water intake rate also is moderate. Tilth is good.

About half the acreage of this unit is used as cropland. The rest supports native grasses and is used as range. Some areas of cropland are irrigated.

If dry-farmed, this soil is suited to winter wheat, millet, and sunflowers. Soil blowing and water erosion are hazards in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and conserve soil moisture. Stripcropping also helps to control soil blowing by providing a vegetative barrier that protects the soil from the wind. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

If irrigated, this soil is suited to corn; alfalfa; wheat; dry, edible beans; and introduced grasses. Water can be applied by furrow, border, and sprinkler irrigation systems. Soil blowing and water erosion are hazards. A system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and water erosion. If land leveling is needed when a gravity irrigation system is installed, deep cuts may expose the sandy underlying material.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods reduce the amount of protective cover and the quality of native plants. Proper grazing use, timely deferment of grazing and haying, and a planned grazing system help to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and drought are the main hazards. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil generally is suited to septic tank absorption fields and dwellings. The damage to roads by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated; Sandy range site; windbreak suitability group 5.

Yp—Yockey loam, alkali, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil formed in stratified, loamy and sandy alluvium on bottom land. It is occasionally flooded for brief periods. Areas range from 5 to 400 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous loam about 6 inches thick. Next is a transitional layer of pale brown, very friable, calcareous very fine sandy loam about 12 inches thick. The underlying material extends to a depth of 60 inches or more. It is light brownish gray, calcareous loam in the upper part and light gray, calcareous very fine sandy loam in the lower part. In some places the surface layer is very fine sandy loam or loamy very fine sand. In other places the seasonal high water table is below a

depth of 6 feet in the spring during wet years. In these places the soil is subject to rare flooding.

Included with this soil in mapping are small areas of Janise and Lisco soils. These soils are not stratified. They are in landscape positions similar to those of the Yockey soil. Lisco soils have more fine sand than the Yockey soil. Included soils make up 5 to 10 percent of the unit.

Permeability and the available water capacity are moderate in the Yockey soil. Runoff is slow. The seasonal high water table ranges from a depth of about 2 feet during wet years to about 4 feet during dry years. The organic matter content is low. The water intake rate is moderate. The soil has excessive amounts of sodium and other salts. Tilth is fair.

Most areas of this soil support native grasses and are used for grazing and hay. The rest are irrigated cropland.

If dry-farmed, this soil is poorly suited to corn, winter wheat, millet, and sunflowers. The high alkalinity and salinity are the main limitations affecting crop production. Soil blowing is a hazard in areas where the surface is not adequately protected by crops or crop residue. A system of conservation tillage, such as chiseling or disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserve soil moisture. Reclaiming areas of saline and alkali soils is expensive and time consuming. Onsite investigation and technical assistance are needed before reclamation is begun.

If irrigated, this soil is poorly suited to corn and alfalfa. The salinity and alkalinity are the main limitations affecting crop production. These limitations affect the water intake rate and restrict the growth of crops. Sprinkler irrigation systems increase the efficiency of irrigation. Soil blowing is a hazard. Winter cover crops help to control soil blowing. A system of conservation tillage, such as chiseling, disking, no-till plant, or till plant, that keeps crop residue on the surface helps to control soil blowing and conserve moisture. Returning crop residue to the soil increases the content of organic matter, improves fertility, and helps to maintain tilth.

In the areas used as range or hayland, the climax vegetation is dominantly alkali sacaton, inland saltgrass, western wheatgrass, slender wheatgrass, and plains bluegrass. These species make up 65 percent or more of the total annual forage. Foxtail barley, switchgrass, sand dropseed, blue grama, sedges, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, alkali sacaton, western wheatgrass, and switchgrass decrease in abundance and are replaced by inland saltgrass, blue grama, bluegrass, foxtail barley, sand dropseed, and alkali-tolerant sedges. If overgrazing or improper haying continues for many years, inland saltgrass, blue grama, bluegrass, foxtail barley, alkali-tolerant sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Properly located fences and livestock watering and salting facilities can result in a more uniform distribution of grazing. The alkalinity limits forage production and greatly influences the kind of plants that grow. Some very strongly alkaline areas support little or no vegetation and are subject to severe soil blowing during dry periods. Careful management is needed to maintain the plant cover.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws.

This soil is poorly suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can tolerate the salinity and alkalinity of the soil. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Irrigation can supply the moisture needed during periods of low rainfall. In wet years planting needs to be delayed until the soil is sufficiently dry. Weeds and undesirable grasses can be controlled by cultivation with conventional equipment and by timely applications of the appropriate herbicide.

This soil is not suited to septic tank absorption fields and dwellings because of the flooding and wetness. A suitable alternative site should be selected. Constructing roads and streets on suitable, well compacted fill material above the flood level, providing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding.

The land capability units are IVs-1, dryland, and IIIs-6, irrigated; Saline Subirrigated range site; windbreak suitability group 9S.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should

encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 193,000 acres in the survey area, or nearly 40 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in associations 1, 2, 8, 10, and 11, which are described under the heading "General Soil Map Units." Nearly all of this prime farmland is used for crops, mainly wheat.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that receive an inadequate amount of rainfall qualify as prime farmland only in areas where this limitation has been overcome by irrigation. The need for irrigation is indicated after all of the map unit names in table 5. Onsite evaluation is needed to determine whether or not a specific area is irrigated.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

William E. Reinsch, conservation agronomist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Cropland makes up approximately 45 percent of the total land used for agricultural purposes in Banner County. Nearly 15 percent of the cultivated cropland is irrigated. Small grain and hay are the main crops. Other crops grown include corn; dry, edible beans; and alfalfa.

Management for Dryland Crops

Although dryland crops are grown in scattered areas throughout the county, the greatest concentration of areas used for wheat-fallow rotation is in the southern and southwestern parts. Dryland crops are grown mainly in areas of the Alliance-Keith-Sidney and Bayard-Bridget associations.

In Banner County insufficient rainfall commonly is a limiting factor affecting crop production. Water erosion and soil blowing can prevent maximum crop production. Good management in areas used for dryland crops reduces the runoff rate, helps to control soil blowing and water erosion, conserves moisture, and improves tilth.

Erosion is the major problem on nearly all of the soils used as cropland in the county. It is also a major problem in areas of pasture that have been overgrazed. All of the soils in the county are susceptible to soil blowing and water erosion. Soil blowing is most severe

during March, April, and November.

Stripcropping and a conservation tillage system that keeps crop residue on the surface help to control water erosion. Keeping crop residue on the surface or growing a protective plant cover minimizes crusting during and after heavy rains. In winter the stubble holds snow on the field and thus increases the moisture supply. Terraces reduce the length of slopes and thus reduce the runoff rate and help to control erosion. Level terraces are most practical on moderately sloping upland soils and on long, rather smooth slopes.

Soil blowing is a major problem in areas of the Tripp-Alice, Satanta-Alliance-Canyon, and Otero-Bayard-Sarben associations. Keeping crop residue on the surface throughout the winter or until planting helps to control soil blowing. A conservation tillage system that leaves crop residue on the surface and stripcropping are the most economical ways to control soil blowing.

Contour stripcropping, wind stripcropping, and conservation tillage help to control soil blowing and water erosion on cropland. Contour stripcropping is best suited to soils in areas where both water erosion and soil blowing are problems. The strips should be narrow and perpendicular to the prevailing wind.

Erosion is damaging because productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Also, soil blowing causes damage to growing crops and to rangeland.

Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife habitat.

The cropping system and management practices that help to control erosion should be planned so that they are effective on the soil in each field. This planned management is known as a resource management system. Resource management systems in areas of dryland crops help to preserve soil tilth and fertility, maintain a surface cover that protects the soil from erosion, and control weeds, insects, and diseases.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. Regular additions of crop residue, manure, and other organic material improve soil structure and tilth.

Systems for managing cropland resources vary according to the soils on which they are used. For example, a resource management system in an area of Alliance loam, 1 to 3 percent slopes, would include wind strips that are 300 feet wide and a system of conservation tillage that could maintain 400 pounds of small grain residue on the surface after planting or would include a conservation tillage system that could maintain 1,000 pounds of small grain residue on the surface after planting.

Occasionally, tillage is needed to prepare a seedbed, control weeds, and provide a favorable place for plants to grow. Excessive tillage, however, reduces the extent of the plant cover and thus increases the hazard of soil blowing. Tillage practices should be limited to those that are essential. Various tillage practices can be used in Banner County. No-till and stubble-mulch systems are well suited to small grain crops. Grasses and legumes can be established without further seedbed preparation by drilling into a cover of stubble.

Soil fertility in most of the eroded soils and in the moderately deep soils in the county is naturally lower than in the uneroded, deep soils. All soils, however, require additional plant nutrients for optimum production. The kind and amount of fertilizer to be applied to the soils used for dryland crops should be based on the results of soil tests. Nitrogen and phosphorus are the elements added to most cultivated areas. In some areas trace elements are needed.

Management for Irrigated Crops

Corn and alfalfa hay are grown on about 42 percent of the irrigated cropland in the county (fig. 13). A smaller percentage of the acreage is used for wheat; dry, edible beans; sugar beets; and other crops. The irrigation water is obtained from wells. The greatest concentration of irrigated cropland is along Pumpkin Creek. Gravity or sprinkler systems are suited to the areas used for row crops. Alfalfa is generally irrigated by border, ditch, or sprinkler systems. Careful management of irrigation water is needed to prevent leaching of plant nutrients and pesticides below the plant roots.

The cropping sequence on soils that are well suited to irrigation consists mostly of row crops. A crop rotation that includes different crops, such as corn and dry, edible beans, helps to control the diseases and insects that are common if the same crop is grown year after year.

Gently sloping soils, such as Mitchell very fine sandy loam, 3 to 6 percent slopes, are subject to water erosion if they are furrow irrigated down the slope. If furrow irrigated, these soils should be contour bench leveled or a conservation tillage system should be used. Land leveling increases the efficiency of irrigation because it results in an even distribution of water.

Contour farming and conservation tillage practices that keep crop residue on the surface help to control both water erosion and soil blowing on soils irrigated by a sprinkler system. When water is applied by the sprinklers at a controlled rate, it is absorbed by the soil

Figure 13.—Sprinkler irrigation in an area of Otero loamy very fine sand, 0 to 3 percent slopes, used for alfalfa.

and does not run off the surface. Sprinklers can be used on the more sloping soils and on the nearly level soils. Some soils, such as Alliance loam, 6 to 9 percent slopes, eroded, are suited to sprinkler irrigation only if erosion is controlled. Because the application of water can be carefully regulated, sprinklers can be used for special purposes, such as establishing a new pasture on moderately steep soils. The most common types of sprinkler irrigation in Banner County are center-pivot and wheel-roll systems.

Furrow irrigation is most efficient if it is started after the plants have used about half of the available water in the soil. Thus, if a soil holds 8 inches of available water, irrigation should be started when about 4 inches has been removed by the crop.

A tailwater recovery pit can be installed to trap excess irrigation tailwater. This water can then be pumped back onto the field and used again. This practice increases the efficiency of the irrigation system and conserves the water supply.

All of the soils in Nebraska are assigned to irrigation design groups *(8)*. If applicable, an irrigation capability unit is specified at the end of the map unit descriptions under the heading "Detailed Soil Map Units." The Arabic number at the end of the irrigation capability unit indicates the irrigation design group to which the soil is assigned.

Assistance in planning and designing an irrigation system can be obtained at the local office of the Soil Conservation Service. Estimates of the cost of irrigation equipment can be obtained from local dealers and manufacturers.

Weed Control

A suitable cropping sequence or appropriate herbicides help to control weeds. Rotating different crops in a planned sequence not only helps to control weeds but also increases the productivity of the soil and the content of organic matter. The kind and amount of herbicide applied to the soil should be carefully controlled. The colloidal clay and humus fractions of the soil are responsible for most of the chemical activity in

the soil. Applications of some herbicides on soils that have a low content of colloidal clay, such as Bayard soils, and on soils that have a low content of organic matter, such as Mitchell soils, can cause crop damage.

Management of Pasture and Hayland

Hayland or pasture should be managed for maximum forage production. After a pasture is established, the grasses should be kept productive. In Banner County pastures of cool-season grasses consist mainly of western wheatgrass, intermediate wheatgrass, and pubescent wheatgrass. These grasses start to grow in the spring and reach their peak growth in May and June. They are dormant during July and August unless the pasture is irrigated. For this reason, these cool-season grasses should be managed in a planned grazing system along with pastures of native range. The management of introduced pastures should include rotation grazing. Introduced pasture grasses are more productive if spring grazing is delayed until the grasses have reached a height of 5 to 6 inches. Until the plants reach this height, they grow on food reserves stored in their roots and rhizomes. Grazing too early in the spring or too late in the fall reduces the vigor of the plants. Other cool-season grasses and legumes that are adapted to irrigated areas in Banner County are smooth bromegrass, creeping foxtail, meadow bromegrass, reed canarygrass, alfalfa, cicer milkvetch, orchardgrass, and birdsfoot trefoil.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-1 and IVe-3.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units," in the yields table, and in the section "Interpretive Groups," which follows the tables at the back of this survey.

Rangeland

Kenneth L. Hladek, range conservationist, Soil Conservation Service, helped prepare this section

The original plant cover in most of Banner County was short prairie grasses. Approximately 50 percent of the agricultural land in the county currently supports short prairie grasses and is used as rangeland. The rangeland is in scattered areas throughout the county. The largest acreages, however, are in the Canyon-Rock outcrop, Tassel-Busher-Rock outcrop, and Valent-Sarben associations. The Valent association is used almost exclusively as range.

The raising of livestock, mainly cow-calf herds from which calves are sold in the fall as feeders, is one of the most important agricultural industries in the county. Cattle in the larger ranching areas generally graze areas of range from late in the spring to early in the fall. They graze crop residue the rest of the year and graze pastures near the ranch headquarters in winter. The livestock are fed native hay or alfalfa, or both, during winter and during other periods when heavy snow covers the ground. The forage produced on rangeland is generally supplemented with protein during the fall and winter.

Some of the rangeland in Banner County produces less than half of its potential because it has been continuously overgrazed in the past. Poor grazing distribution and some brush encroachment have also reduced the production of forage.

Proper management of range and native hayland is one of the most important factors affecting the conservation of soil, water, and plant resources in the county. Good range management can improve forage yields and thus increase livestock production.

This section can aid ranchers and conservationists in planning the management of range. It defines range sites, explains the evaluation of range condition, and describes planned grazing systems and other aspects of range and hayland management.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 8 shows, for nearly all the soils, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 8 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody

plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Range condition is the present state of the vegetation on a range site compared to the potential, or climax vegetation, for that site. Climax vegetation is a stable plant community that represents the most productive combination of forage plants on a given range site and represents the highest potential in kind and amount of vegetation for a given range site. It reproduces itself naturally and changes little as long as the climate and soil conditions remain unchanged.

Determining the range condition provides an approximate measure of the overall health of the plant community. More importantly, it provides a basis for predicting the degree of improvement possible under different kinds of management. Four condition classes are used to indicate the departure from the potential, or climax vegetation. They are excellent, good, fair, and poor.

All food that plants use for growth is manufactured in their leaves. Removal of plant leaves during the growing season affects the growth of both roots and shoots. Livestock graze selectively, removing more leaves from some plants than from others. This selective grazing varies according to the season and the kind and class of livestock. Because livestock graze selectively, various plants respond to continuous heavy grazing in different ways. Some decrease in abundance, some increase in abundance, and others not originally part of the plant community invade the range site. Plant responses to grazing are used in classifying the range condition.

The *decreaser species* are those species in the original plant community that decrease in abundance if grazed closely and continuously during the growing season. The *increaser species* are those species in the original plant community that increase in abundance under continuous heavy grazing as the decreaser plants become less abundant. The *invader species* are those species not in the original plant community that begin to grow on a site after the decreaser and increaser species have been weakened or eliminated. Once the range condition has been determined, it is important to know whether the range is improving or deteriorating in order to plan adjustments in grazing use and management. Important factors affecting trends in the plant community are the vigor and reproductive capacity of both desirable and undesirable species.

The goal of range management is excellent range condition. The highest forage yields are obtained on a sustained basis when the range is in excellent condition. In addition, soil blowing and water erosion are kept at an acceptable level without applying conservation practices and maximum use is made of precipitation by plants.

At the end of each description under the heading "Detailed Soil Map Units," the soil has been assigned to a range site. These classifications are based on the kind and amount of vegetation that can be expected when the site is in excellent condition.

The following paragraphs describe the management needed on the range in Banner County. The management includes proper grazing use, planned grazing systems, deferred grazing, range seeding, control of blowouts, brush control, and management of native hayland.

Proper Grazing Use

Proper grazing use is grazing at an intensity that maintains sufficient plant cover to protect the soil and that maintains or improves both the quantity and quality of desirable vegetation. It is the first and most important step in successful range management. It increases the vigor and reproductive capacity of desirable plants, leaves enough accumulated litter and mulch on the surface to help control erosion, and increases forage production. The proper intensity of grazing used on rangeland during the entire growing season removes no more than half of the current year's growth, by weight.

Proper grazing use is generally determined by the degree to which desirable species are grazed in key areas. It is affected by stocking rates, distribution of livestock, and the kinds and classes of livestock.

The stocking rate is the number of grazing animals in a particular pasture. It is based on animal units and animal unit months. An *animal unit* is a measurement of livestock numbers based on the equivalent of one mature cow, weighing approximately 1,000 pounds, and a calf that is at least 4 months of age or the equivalent of the cow and calf. An *animal unit month* is the amount of forage or feed necessary to sustain an animal unit for 1 month. The range site and the range condition are used to determine animal unit months for each pasture. The suggested initial stocking rate for range sites in excellent condition is given for many of the soils under the heading "Detailed Soil Map Units." The rates are lower for range sites in less than excellent condition.

The suggested initial stocking rate for rangeland is relatively easy to calculate for any given soil or range site. For example, in an area of Valent fine sand, rolling, the suggested initial stocking rate is about 0.5 animal unit month per acre if the range is in excellent condition. Thus, a 640-acre pasture in excellent condition can carry about 320 animal units for 1 month. If the pasture is to be grazed for 5 months, then the suggested initial stocking rate would be about 64 animal units. The initial suggested stocking rate is based on the condition of the existing plant community and the average annual production of each range site. Because of weather conditions, forage production varies. The suggested rate is intended as an initial stocking rate and should be adjusted to changes in forage production or the management system.

The proper distribution of livestock throughout a pasture requires planning. Livestock tend to graze most heavily in areas near livestock watering and salting facilities, in areas near roads and trails, and in gently sloping areas. Distant corners of pastures, steep terrain, and areas away from watering facilities are often undergrazed. Poor grazing distribution can result from too few watering facilities or from poorly distributed watering and salting facilities, shade, and supplemental feed. A continued concentration of livestock in an area results in severe overuse of that area and a hazard of erosion while the other areas are left underused. Carefully locating fences and salting and watering facilities and applying a planned grazing system help to achieve a uniform distribution of grazing.

Fences help to distribute grazing in a more uniform pattern. Also, they divide pastures into sections used in a planned grazing system and keep livestock out of blowouts and reseeded areas. Cross fences should be located so that they follow natural land features and range sites as much as possible. The potential stocking rate should be similar for all pastures. Generally, the smaller pastures are used more efficiently by livestock than are larger pastures. This efficiency in forage use should be considered in addition to the convenience in operation when the pasture size is determined.

Properly locating salt and mineral facilities is one of the easiest and most economical means of achieving a uniform distribution of grazing in a pasture. The salt and mineral facilities should be located away from water facilities. They can be easily moved to areas that are undergrazed and can be relocated at different times throughout the grazing season. On the sandy soils of the Valent association, relocating the salting station each time that salt is provided lessens the hazard of soil blowing.

Properly located watering facilities also can improve the distribution of grazing. In Banner County, most livestock water is obtained from natural springs and from wells that are pumped by windmills. Some dugouts are on the wetter range sites. Stockwater dams are mainly in the soil associations that have coarser soil textures. They provide water to livestock in areas where drainage provides adequate runoff. Watering facilities should be spaced at varying distances, depending on the terrain. In rough or hilly areas, the distance between facilities should not be more than 0.5 mile. In the more level areas, it should be no more than 1.0 mile. If the distance is too far, the areas near water sources will be overgrazed.

Range management is also dependent on the kinds and classes of livestock grazing the pasture. Cattle, sheep, and horses have different grazing habits and nutritional needs that affect the way range can best be managed for proper grazing use. Cattle are the main livestock raised in the county. They are well suited to grazing in areas of the major range sites in the county. Grazing habits also differ among classes of cattle. Yearlings graze in more areas of a pasture than cows with calves. Their tendency to trail along fence lines can sometimes result in erosion. Yearlings also graze the

steeper areas and will graze a pasture more uniformly than cows with calves. Cow-calf pairs tend to graze more on the gentler slopes and stay closer to watering facilities than yearlings. As a result, poor grazing distribution may be more of a problem in pastures stocked with cows and calves than in those stocked with yearlings. Only a few horses and sheep are raised in the county.

General management techniques outlined in this section and in the "Detailed Soil Map Units" section apply principally to cattle production. Management techniques may need adjustment if other livestock are grazed.

Planned Grazing Systems

Planned grazing systems are effective in achieving maximum forage production and livestock performance while controlling erosion. In a planned grazing system, two or more pastures are alternately rested and grazed in a planned sequence over a period of years. The rest periods are planned for sometime during the growing season. All livestock should be removed from the pasture being rested. These pastures are grazed in a different sequence each year. By not grazing the same pasture at the same time each year, the plants are not close-cropped by livestock at the same stage of development every year. Planned grazing systems make it possible for plant vigor and forage production to increase and the plant community to improve, thus resulting in a better range condition. Planned grazing systems permit maximum and uniform use of forage, while maintaining rangeland productivity over a period of years. They also help to overcome the adverse effects of drought and other climatic conditions on plants.

To be effective, planned grazing systems must be flexible and adapted to the needs of an individual rancher. Fences, watering facilities, range condition, range sites, kinds or classes of grazing animals, and economic factors are all important considerations in determining the best system for a particular ranch. Grazing systems should be modified over a period of time because of improved plant vigor, increased forage production, or changes in management needs.

Planned grazing systems can increase stocking rates through an increase in forage production and improved forage quality. They also minimize the formation of blowouts and may reduce the number of parasites and the likelihood of diseases among cattle since the pastures are usually cleaner than those continuously grazed.

Deferred Grazing

Deferred grazing is the resting of grazing land for a prescribed period. The need for deferment is based on the range condition and range trend. To be beneficial, deferment should be for a minimum of 3 consecutive months and should coincide with the critical growth period of the desirable plants. This period varies, depending on the grass species. The maximum benefit from deferment coincides with the food storage period. For native warm-season grasses this period occurs from late July to early October. On some sites a short deferment of 3 months is all that is needed, while on other sites a deferment of two complete growing seasons of continuous rest may be needed. Generally, some grazing throughout the year is more beneficial than a complete year long deferment. Following the period of deferment, the pasture can be grazed after the first heavy frost in the fall or early in the spring before the warm-season grasses begin to grow. If the pastures are grazed in winter, protein supplements are needed to meet the nutritional needs of cattle.

Deferred grazing allows plants a rest period during critical times in their growth stages. This period allows grasses to become vigorous and to produce a mulch at the surface, thus increasing the rate of water infiltration. The mulch also reduces the susceptibility of the soil to erosion. Deferred grazing also promotes natural grass reseeding by allowing the desirable species to set seed and, more importantly, to spread vegetatively.

Where severe overgrazing has eliminated the native grasses, reseeding the range to adapted native grasses is the best method of restoration. Native range should be reseeded only after careful evaluation.

Range Seeding

In some areas, such as formerly cultivated fields and abandoned farmsteads, range management alone cannot restore a satisfactory cover of native vegetation. Range seeding may be needed in these areas (fig. 14). It may also be needed in severely overgrazed areas where the native vegetation has deteriorated so much that it will not respond to management practices.

Good stands of native grasses can be reestablished if the seedbed is properly prepared, adapted species of native grasses are selected for planting, the correct seeding methods are used, and careful management is applied after seeding.

Range seeding is most successful when the seedbed is firm and has a cover of mulch. A firm seedbed helps to ensure good soil-seed contact, which is essential for seedling development. The cover of mulch helps keep the soil moist, lowers the temperature of the surface soil, and helps to control erosion. It can be provided by planting a temporary crop, such as sudangrass or grain sorghum. The grass should be seeded directly into the stubble the following fall, winter, or spring. Tillage should be avoided because a firm seedbed is needed.

Figure 14.—An area of Sarben loamy very fine sand, 3 to 9 percent slopes, that supports reseeded grasses.

On soils that have a coarser textured surface layer and are subject to soil blowing, preparing the seedbed and seeds in narrow strips over a period of several years or planting the seeds with a range interseeder help to control soil blowing.

Seeding mixtures should consist of adapted native grasses that are normally on the site when it is in excellent range condition. Consequently, they vary according to the soils and range sites. Using a grassland drill with depth bands ensures the proper placement of seeds at a uniform depth. A range interseeder should be used in areas that have a severe hazard of soil blowing when the soils are tilled during seedbed preparation. It places seeds in the center of a shallow furrow without disturbing the vegetation between the furrows.

Generally, newly seeded areas should not be fully grazed until after the grass is established. Establishment may take 2 or 3 years, depending on the grass species, the range site, the method of planting, and the weather. Initial grazing of these areas should be light. Limited grazing in early spring or in late fall and winter helps to control weeds until the grass is established. Proper grazing use and a planned grazing system help to keep the range productive after the grass is established.

Additional information about appropriate grass mixtures, grassland drills, and planting times can be

obtained at the local office of the Soil Conservation Service.

Control of Blowouts

Blowouts form on sandy soils, mainly in areas of the Valent and Valent-Sarben associations, where the vegetation has been removed. Many blowouts form in areas of the sandhills that have been subject to continuous heavy grazing. Larger blowouts generally form in areas near wells where livestock tend to concentrate. Smaller blowouts are more likely to form along trails or fence lines. Drought increases the likelihood that blowouts will form.

Unless stabilized, blowouts are likely to become larger. The wind blows the sand to bordering areas, where the windblown sand smothers the vegetation. The result is an expanding area that is subject to severe soil blowing.

A planned grazing system can stabilize many blowouts in 4 or 5 years. Locating wells and salt and mineral facilities away from the blowouts helps to prevent the concentration of livestock in the area. A planned grazing system is the most effective way to minimize the formation of blowouts.

If a planned grazing system is not feasible, reseeding may be necessary. If blowouts are reseeded, steep banks around the edge of the blowouts should be reshaped into a stable slope. If a quick-growing cover crop is planted in the spring, an adapted native grass mixture can be drilled into the stubble left from the crop. The cover crop helps to protect the surface from soil blowing, lowers the soil temperature, and creates a firm seedbed. If a cover crop is not practical, a mulch of native hay can be spread over the surface and worked into the sand after seeding. Mulching helps to prevent the damage caused by windblown sand while the grasses become established. Fencing blowout areas after seeding helps to keep out livestock until a desirable stand is established. Proper grazing use and a planned grazing system help to prevent the reactivation of stabilized blowouts after the grasses are established.

Brush Control

Small soapweed, western snowberry, and sand sagebrush are the main brush species in the county. Although they are not a major problem, these plants encroach on the land and reduce forage yields and carrying capacity by shading out desirable grasses and by competing for water and nutrients.

Small soapweed can generally be controlled by winter grazing. If it is grazed during the winter, it loses vigor and may be broken off below the root crown. Feeding cottonseed cake as a protein supplement increases the amount of small soapweed that cattle consume. Applications of approved herbicide have been only spotty in effectiveness.

Western snowberry and sand sagebrush are best controlled by applications of approved herbicide. Repeated applications for several consecutive years may be needed to control western snowberry. Areas treated with herbicide should be deferred from grazing to allow adequate recovery of grasses. Herbicide recommendations can be obtained from the county extension agent or at the local office of the Soil Conservation Service.

Management of Native Hayland

A very small acreage of rangeland in the county is used for the production of native hay. Most of the hay is cut in areas of the deeper lowland soils and their associated range sites. Hay is harvested in a few upland areas that are generally used for grazing. The hayfields are generally in the Sandy Lowland, Sandy, or Sands range sites.

Proper management can maintain or improve the production of hay. Timely mowing is needed to maintain strong plant vigor and high quality and quantity of forage. Mowing the grasses between the boot stage and the emergence of the seed heads allows for adequate regrowth and carbohydrate storage in the plant roots before the first frost. The regrowth also helps to hold snow on the surface in the winter and thus increases the supply of soil moisture. A mowing height of 3 inches or more helps to maintain plant vigor and promotes rapid regrowth. Meadows can be moderately grazed without damage after frost in the late fall.

Hay grown in upland areas should be harvested only every other year. During the following year, grazing only in the fall or winter allows the warm-season grasses to regain vigor and suppresses the cool-season grasses and weeds.

Technical assistance in managing range and hayland can be obtained at the local office of the Soil Conservation Service.

Native Woodland

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

In Banner County native woody vegetation grows on steep uplands in areas of the Tassel-Busher-Rock outcrop and Canyon-Rock outcrop associations and on bottom land in areas of the Janise-Yockey, alkali-Lisco and Bankard-Bayard associations. The acreage of woodland is small and scattered and thus is of limited value as a commercial resource. The woodland, however, is an important resource for local use.

The amount of ponderosa pine is steadily increasing.

Figure 15.—A farmstead windbreak of cedar trees that catches snow and protects the farmstead during the winter.

It grows in mostly pure stands throughout the breaks. Generally, the north- and east-facing slopes have larger trees. These areas also have a denser population of trees. Rocky Mountain juniper is interspersed with the ponderosa pine. Also, dense patches of skunkbush sumac and mountain mahogany are on the breaks and foot slopes. Common chokecherry, American plum, golden currant, western snowberry, green ash, and other species grow in brushy draws in the breaks.

Bottom land areas, such as Pumpkin Creek and Hackberry Draw, have sparse populations of trees. Eastern cottonwood, or plains cottonwood, and peachleaf willow are the predominant species. Other species include green ash, hackberry, and boxelder.

Windbreaks and Environmental Plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

Windbreaks and environmental plantings have been planted at various times on most farmsteads and ranch headquarters in Banner County (fig. 15). Siberian elm is the predominant species on the ranch headquarters. Rocky Mountain juniper and eastern redcedar are also important. Other species include Russian-olive, green ash, hackberry, ponderosa pine, lilac, American plum, chokecherry, eastern cottonwood, and mulberry.

On numerous farmsteads almost all trees are Siberian elm. Supplemental plantings of shrubs and evergreen trees are needed to provide high-quality protection from the wind. Planting trees and shrubs is a continual process because short-lived trees, such as Siberian elm, pass maturity and deteriorate; some trees and shrubs are destroyed by insects, diseases, or storms; and new plantings are needed on expanding ranches.

Only a small number of field windbreaks are in the county; however, some new field windbreaks are being planted in the corners or around the borders of fields irrigated by center-pivot systems. Field windbreaks usually consist of two to four rows of trees and shrubs.

Some of the field windbreaks are planted in a pattern at intervals of 300 to 400 feet. Others are planted in a single belt along the borders of fields or adjacent to roads. Rocky Mountain juniper, eastern redcedar, Siberian elm, honeylocust, honeysuckle, Russian-olive, ponderosa pine, hackberry, skunkbush sumac, and green ash are the most common species planted in field windbreaks.

The species of trees and shrubs grown as windbreaks should be those that are suited to the soils on the selected site. Permeability, available water capacity, fertility, soil depth, and soil texture greatly affect the growth rate of trees and shrubs. Selecting suitable species is the first step toward ensuring survival and a maximum growth rate.

Trees and shrubs are difficult to establish in the county because of a limited supply of moisture. Proper site preparation before planting and control of competing vegetation after planting are the major management objectives when establishing windbreaks in the county. Cover crops may be needed to protect the new plants from hot winds and windblown soil. Supplemental watering is needed during dry periods.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

At the end of each description under the heading "Detailed Soil Map Units," the soil has been assigned to a windbreak suitability group. These groups are based primarily on the suitability of the soil for the locally adapted species, as is indicated by their growth and vigor. Detailed interpretations for each windbreak suitability group in the county are provided in the "Technical Guide," which is available in the local office of the Soil Conservation Service.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Robert O. Koerner, biologist, Soil Conservation Service, helped prepare this section.

The opportunities for recreation in Banner County are limited mainly to hunting deer, antelope, wild turkey, ring-necked pheasant, prairie grouse, and mourning dove. Hunting on private lands is by permission of the landowner. Another recreational opportunity is photography of plants, animals, and landscapes in scenic areas of the Wildcat Hills. More than 30 ponds have been constructed and have been stocked with rainbow trout or largemouthed bass and bluegills. These ponds are on private lands, and the landowner's permission is required prior to fishing. No known public recreational facilities are in the county.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table

13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Robert O. Koerner, biologist, Soil Conservation Service, helped prepare this section.

The kinds of wildlife habitat in Banner County vary, depending on the soil, topography, vegetation, slope, and drainage pattern. The county has a wide diversity of cover types. The drainage pattern is generally east to southeast. Springs and seeps provide water year round. Wildlife also can use succulent vegetation, rain, or snow as a source of water. Some hollow depressions in the upland areas are filled with water during seasonal periods.

The Tassel-Busher-Rock outcrop association supports native stands of ponderosa pine, which provide protective cover for deer. The deer find food in the adjacent cropland. Wild turkey also inhabit this association. They eat seeds from the pine trees and grain and insects from the adjacent fields. The trees are used as perches by hawks, owls, eagles, and other birds of prey. Mountainmahogany (Cercocorpus montanus) is found in solid stands in the association. It is a valuable native species used as winter browse by deer.

The tableland in the western part of the county and the areas of cropland adjacent to streams provide openland wildlife habitat for pheasant, mourning doves, and songbirds.

The Valent, Canyon-Rock outcrop, Otero-Bayard-Sarben, Tripp-Alice, and Valent-Sarben associations provide grassland nesting areas for prairie grouse and other species of birds. Other rangeland wildlife, such as antelope, badger, skunk, jackrabbit, and coyote, also inhabit these associations.

Because the population of people in the county is sparse, conditions are favorable for undisturbed wildlife habitat, except during hunting seasons. In areas around inhabited farmsteads, trees are planted for protection from the wind. These trees also provide food and cover for wildlife.

Areas irrigated by center-pivot systems are mainly along Pumpkin Creek. Corn, the main crop in these areas, provides additional food for wildlife. The county has many abandoned farmsteads that provide wildlife habitat.

Areas along fencelines and road ditches and thickets of plum, chokecherry, and Russian-olive provide food and cover for pheasant, cottontail, and songbirds. Field windbreaks and the edge along stripcropped fields provide escape cover for all wildlife species.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair*

indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and millet.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, bromegrass, birdsfoot trefoil, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are little bluestem, goldenrod, beggarweed, western wheatgrass, and blue grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are green ash, hackberry, and eastern cottonwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, common chokecherry, and American plum.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are ponderosa pine, eastern redcedar, and Rocky Mountain juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are skunkbush sumac, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattails, prairie cordgrass, rushes, sedges, and northern reedgrass.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and coyote.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, prairie grouse, thrushes, woodpeckers, squirrels, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, prairie grouse, meadowlark, and lark bunting.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils

and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally

limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-

water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 16). "Loam," for example, is soil that is

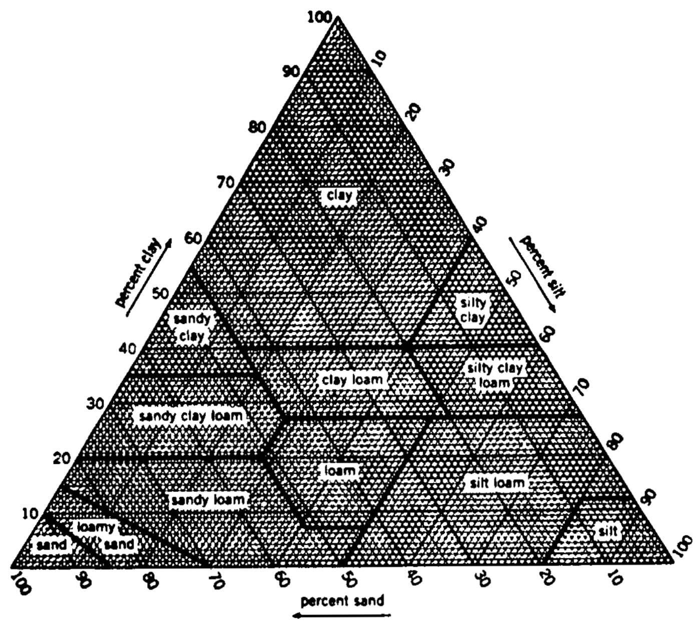

Figure 16.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering

properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. In Nebraska, the group index numbers range from -4 for the best subgrade material to 32 for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for

fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often during normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in

evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); and Specific gravity—T 100 (AASHTO), D 854 (ASTM). The group index number that is part of the AASHTO classification is computed by the Nebraska Modified System.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(7)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittently dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Aridic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, mesic Aridic Haplustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(9)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(7)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alice Series

The Alice series consists of deep, well drained, moderately rapidly permeable soils on stream terraces. These soils formed in loamy and sandy sediments. Slopes range from 0 to 9 percent.

Alice soils are commonly near Bayard, Dix, and Tripp soils. Bayard and Tripp soils are in landscape positions similar to those of the Alice soils. Bayard soils do not have a cambic horizon or a layer of carbonate accumulations. Tripp soils have less sand in the control section than the Alice soils. Dix soils are shallow over sand and gravel. They are lower on the landscape than the Alice soils.

Typical pedon of Alice fine sandy loam, 0 to 3 percent slopes, 200 feet south and 200 feet east of the northwest corner of sec. 35, T. 20 N., R. 57 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

A—7 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; mildly alkaline; clear smooth boundary.

Bw—10 to 22 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; soft, very friable; mildly alkaline; abrupt wavy boundary.

Bk—22 to 30 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; slightly hard, very friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C—30 to 60 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum and the depth to carbonates range from 18 to 38 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches.

The A horizon has value of 4 to 6 (2 or 3 moist) and chroma of 2 or 3. The Bw, Bk, and C horizons are fine sandy loam, loamy very fine sand, or very fine sandy loam and have less than 18 percent clay. The Bw horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. The Bk horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. The C horizon has value of 7 or 8 (5 or 6 moist) and chroma of 2 or 3.

Alliance Series

The Alliance series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying calcareous sandstone bedrock. Slopes range from 0 to 9 percent.

Alliance soils are commonly near Altvan, Duroc, Goshen, Keith, and Rosebud soils. Altvan, Keith, and Rosebud soils are in landscape positions similar to those of the Alliance soils. Altvan soils are moderately deep over gravelly coarse sand. Keith soils do not have sandstone bedrock within a depth of 60 inches. Rosebud soils are moderately deep over sandstone bedrock. Duroc and Goshen soils are dark to a depth of more than 20 inches. They are lower on the landscape than the Alliance soils.

Typical pedon of Alliance loam, 1 to 3 percent slopes, 2,000 feet west and 2,300 feet south of the northeast corner of sec. 18, T. 17 N., R. 56 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

Bt1—8 to 11 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, firm; neutral; clear smooth boundary.

Bt2—11 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure; hard, firm; mildly alkaline; clear smooth boundary.

Bt3—17 to 24 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

BC—24 to 27 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C—27 to 44 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline; abrupt wavy boundary.

Cr—44 to 60 inches; white (10YR 8/2), weakly cemented, calcareous, fine grained sandstone bedrock, light gray (10YR 7/2) moist; strong effervescence.

The thickness of the solum and the depth to carbonates range from 16 to 35 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. Depth to the Cr horizon ranges from 40 to 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loam, but the range includes silt loam and very fine sandy loam. The Bt horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It is typically clay loam and loam, but the range includes silt loam and silty clay loam. The BC horizon has value of 6 or 7 (4 to 6 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam and very fine sandy loam. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. It is typically loam,

but the range includes very fine sandy loam and silt loam.

Alliance loam, 6 to 9 percent slopes, eroded, does not have the mollic epipedon that is definitive for the series. This difference, however, does not significantly affect the use and management of the soil.

Altvan Series

The Altvan series consists of well drained soils that are moderately deep over gravelly coarse sand. Permeability is moderate in the solum and very rapid in the underlying material. These soils formed in loamy material on uplands. Slopes range from 3 to 9 percent.

Altvan soils are commonly near Alliance, Eckley, Rosebud, and Satanta soils. Alliance and Rosebud soils are in landscape positions similar to those of the Altvan soils. Alliance soils have sandstone bedrock at a depth of 40 to 60 inches. Rosebud soils have sandstone bedrock at a depth of 20 to 40 inches. Eckley soils have very gravelly sand at a depth of 10 to 20 inches. They are on the steeper ridgetops and side slopes. Satanta soils do not have gravelly coarse sand at a depth of 20 to 40 inches. They are higher on the landscape than the Altvan soils.

Typical pedon of Altvan loam, in an area of Satanta-Altvan complex, 3 to 6 percent slopes, 2,300 feet west and 450 feet south of the northeast corner of sec. 14, T. 17 N., R. 58 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

Bt1—7 to 13 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure; hard, firm; neutral; clear smooth boundary.

Bt2—13 to 22 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; moderate coarse prismatic structure; hard, firm; neutral; clear wavy boundary.

2C1—22 to 27 inches; very pale brown (10YR 7/3) coarse sand, brown (10YR 5/3) moist; single grain; loose; violent effervescence; strongly alkaline; clear wavy boundary.

2C2—27 to 60 inches; very pale brown (10YR 7/3) gravelly coarse sand, light brown (10YR 5/3) moist; single grain; loose; about 18 percent gravel, by volume; strong effervescence; strongly alkaline.

The thickness of the solum and the depth to carbonates range from 16 to 38 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. Depth to the 2C horizon ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam and sandy loam. The Bt horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. It is typically sandy clay loam, but the range includes clay loam. The Bk and C horizons, if they occur, have value of 6 or 7 (5 or 6 moist) and chroma of 2 or 3. They are typically loam, but the range includes silt loam and fine sandy loam. The 2C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 3 or 4. It is gravelly coarse sand, gravelly sand, or coarse sand. The content of gravel ranges from about 10 to 35 percent, by volume.

Bankard Series

The Bankard series consists of deep, somewhat excessively drained, rapidly permeable soils on bottom land. These soils formed in stratified sandy alluvium. Slopes range from 0 to 3 percent.

Bankard soils are commonly near Bayard, Glenberg, and Otero soils. Bayard soils are coarse loamy. They have a dark surface soil that is thicker than that of the Bankard soils. They are on foot slopes, alluvial fans, and stream terraces. Glenberg and Otero soils have less sand than the Bankard soils. Glenberg soils are in landscape positions similar to those of the Bankard soils. Otero soils are on foot slopes and alluvial fans.

Typical pedon of Bankard loamy fine sand, 0 to 2 percent slopes, 600 feet east and 700 feet south of the northwest corner of sec. 23, T. 17 N., R. 53 W.

A—0 to 8 inches; brown (10YR 5/3) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; loose; slight effervescence; mildly alkaline; clear smooth boundary.

C—8 to 60 inches; pale brown (10YR 6/3) sand that has thin strata of loam and very fine sandy loam, dark brown (10YR 4/3) moist; single grain; loose; slight effervescence; moderately alkaline.

The carbonates are typically at the surface, but some pedons are noncalcareous in the upper few inches.

The A horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It is typically loamy fine sand or sand, but the range includes loamy coarse sand and loamy sand. The color and texture of the C horizon are stratified. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is sand, fine sand, loamy sand, or loamy fine sand that has strata of silt loam, very fine sandy loam, loam, fine sandy loam, loamy very fine sand, or coarse sand.

Bayard Series

The Bayard series consists of deep, well drained, moderately rapidly permeable soils on alluvial fans, foot

slopes, and stream terraces. These soils formed in loamy and sandy sediments. Slopes range from 1 to 20 percent.

Bayard soils are commonly near Alice, Bankard, Bridget, Otero, Sarben, and Vetal soils. Alice soils have a cambic horizon. They are lower on the landscape than the Bayard soils. Bankard soils are stratified and sandy. They are on bottom land. Bridget, Otero, and Sarben soils are in landscape positions similar to those of the Bayard soils. Bridget soils are coarse silty. Otero and Sarben soils do not have a mollic epipedon. Vetal soils have a pachic epipedon and are leached of carbonates to a depth of 30 inches or more. They are in swales.

Typical pedon of Bayard very fine sandy loam, 1 to 3 percent slopes, 600 feet south and 2,000 feet east of the northwest corner of sec. 8, T. 18 N., R. 56 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

A—6 to 10 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

AC—10 to 18 inches; brown (10YR 5/3) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C1—18 to 34 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—34 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 30 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The depth to carbonates ranges from 8 to 20 inches. The control section averages more than 15 percent fine sand and coarser sand and less than 18 percent clay.

The A, AC, and C horizons are very fine sandy loam, loamy very fine sand, or fine sandy loam. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The AC horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3.

Bridget Series

The Bridget series consists of deep, well drained, moderately permeable soils on foot slopes, stream terraces, and alluvial fans. These soils formed in loamy sediments. Slopes range from 0 to 20 percent.

Bridget soils are commonly near Bayard, Mitchell, and Tripp soils. Bayard, Mitchell, and Tripp soils are in landscape positions similar to those of the Bridget soils. Bayard soils are coarse loamy. Mitchell soils do not have a mollic epipedon. Tripp soils have a cambic horizon and a layer of carbonate accumulations.

Typical pedon of Bridget very fine sandy loam, 1 to 3 percent slopes, 750 feet south and 400 feet east of the northwest corner of sec. 20, T. 20 N., R. 53 W.

Ap—0 to 6 inches; brown (10YR 5/3) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—6 to 13 inches; brownish gray (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

AC—13 to 18 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure; slightly hard, very friable; slight effervescence; mildly alkaline; gradual smooth boundary.

C1—18 to 36 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—36 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 0 to 15 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The control section averages less than 15 percent fine sand and coarser sand and less than 18 percent clay.

The A, AC, and C horizons are very fine sandy loam, loam, or silt loam. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The AC horizon has colors intermediate between those of the A and C horizons. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 to 4.

Busher Series

The Busher series consists of deep, well drained and somewhat excessively drained, moderately rapidly

permeable soils on uplands. These soils formed in sandy and loamy material weathered from sandstone bedrock. Slopes range from 9 to 30 percent.

Busher soils are commonly near Bayard, Bridget, Tassel, and Vetal soils. Bayard, Bridget, and Vetal soils do not have sandstone bedrock within a depth of 60 inches. Bayard and Bridget soils are on stream terraces, alluvial fans, and foot slopes. Vetal soils have a pachic epipedon. They are on foot slopes and in swales. Tassel soils have sandstone bedrock at a depth of less than 20 inches. They are in landscape positions similar to those of the Busher soils.

Typical pedon of Busher loamy very fine sand, in an area of Busher-Tassel loamy very fine sands, 9 to 20 percent slopes, 200 feet north and 2,300 feet east of the southwest corner of sec. 20, T. 20 N., R. 58 W.

A—0 to 7 inches; grayish brown (10YR 5/2) loamy very fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

Bw—7 to 18 inches; light brownish gray (10YR 6/2) loamy very fine sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; gradual smooth boundary.

C1—18 to 27 inches; light brownish gray (10YR 6/2) loamy very fine sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; neutral; gradual smooth boundary.

C2—27 to 48 inches; light gray (10YR 7/2) loamy very fine sand, grayish brown (10YR 5/2) moist; soft, very friable; slight effervescence; moderately alkaline; clear wavy boundary.

Cr—48 to 60 inches; white (10YR 8/2) sandstone bedrock, light gray (10YR 7/2) moist; strong effervescence.

The thickness of the solum ranges from 15 to 40 inches. The depth to carbonates ranges from 18 to 36 inches. The mollic epipedon ranges from 7 to 20 inches in thickness. Sandstone bedrock is at a depth of 40 to 60 inches.

The A, Bw, and C horizons are typically loamy very fine sand, but the range includes very fine sandy loam and fine sandy loam. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 or 3.

Canyon Series

The Canyon series consists of shallow, well drained, moderately permeable soils on uplands. These soils formed in calcareous, loamy material weathered from sandstone bedrock (fig. 17). Slopes range from 3 to 60 percent.

Canyon soils are commonly near Alliance, Creighton, Rosebud, and Sidney soils. Alliance, Creighton, Rosebud, and Sidney soils are lower on the landscape than the Canyon soils. Alliance and Sidney soils have sandstone bedrock at a depth of 40 to 60 inches. Creighton soils do not have sandstone bedrock within a depth of 60 inches. Rosebud soils are 20 to 40 inches deep over sandstone bedrock.

Typical pedon of Canyon loam, in an area of Canyon-Sidney loams, 9 to 20 percent slopes, eroded, 2,640 feet east and 100 feet south of the northwest corner of sec. 1, T. 17 N., R. 56 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; violent effervescence; mildly alkaline; clear smooth boundary.

C—6 to 14 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; about 5 percent sandstone gravel, by volume; violent effervescence; mildly alkaline; clear wavy boundary.

Cr—14 to 60 inches; white (10YR 8/2), weakly cemented, fine grained sandstone bedrock, light gray (10YR 7/2) moist; violent effervescence.

The depth to carbonates ranges from 0 to 6 inches. The depth to sandstone bedrock ranges from 6 to 20 inches.

The A horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3. Some pedons have an AC horizon, which has value of 5 to 8 (3 to 7 moist) and chroma of 2 to 4. The A and AC horizons are typically loam, but the range includes fine sandy loam, very fine sandy loam, and silt loam. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 to 4. It is loam, very fine sandy loam, or gravelly loam. It has 12 to 25 percent clay.

Creighton Series

The Creighton series consists of deep, well drained, moderately permeable soils. These soils formed in loamy sediments on uplands. Slopes range from 1 to 6 percent.

Creighton soils are commonly near Alliance, Altvan, Canyon, Duroc, and Satanta soils. Alliance, Altvan, and Satanta soils are in landscape positions similar to those of the Creighton soils. Alliance and Satanta soils have more clay than the Creighton soils. Alliance soils have sandstone bedrock at a depth of 40 to 60 inches. Altvan

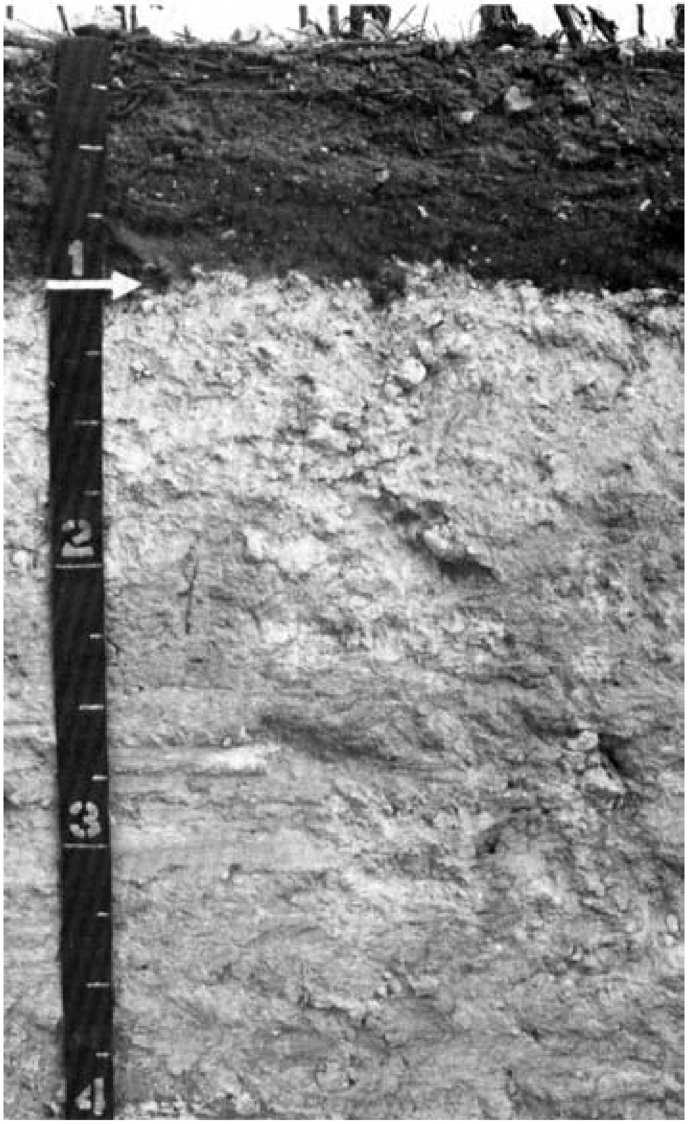

Figure 17.—A typical profile of Canyon loam. The arrow indicates the depth to sandstone bedrock. Depth is marked in feet.

soils are moderately deep over gravelly coarse sand. Canyon soils are shallow over sandstone bedrock. They are higher on the landscape than the Creighton soils. Duroc soils have a mollic epipedon more than 20 inches thick. They are lower on the landscape than the Creighton soils.

Typical pedon of Creighton very fine sandy loam, 3 to 6 percent slopes, 2,300 feet east and 1,100 feet south of the northwest corner of sec. 29, T. 18 N., R. 58 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—7 to 11 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.

Bw—11 to 17 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

BC—17 to 25 inches; light brownish gray (10YR 6/2) very fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C—25 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, light brownish gray (10YR 6/2) moist; white (10YR 8/1 moist) streaks of segregated carbonates; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 40 inches. The depth to carbonates ranges from 6 to 20 inches. The mollic epipedon ranges from 7 to 19 inches in thickness. The control section is very fine sandy loam or loam. It has less than 18 percent clay.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is very fine sandy loam or fine sandy loam. The Bw horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 6. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 to 4.

Dix Series

The Dix series consists of excessively drained soils that are shallow over gravelly sediments. Permeability is rapid in the solum and very rapid in the underlying material. These soils are on breaks to stream terraces, on alluvial fans, on foot slopes, and in the uplands. Slopes range from 0 to 20 percent.

Dix soils are commonly near Alice, Bayard, and Tripp soils. Alice, Bayard, and Tripp soils do not have very gravelly coarse sand within a depth of 60 inches. Alice and Tripp soils are higher on the landscape than the Dix soils, and Bayard soils are lower on the landscape. Tripp soils are finer textured than the Dix soils.

Typical pedon of Dix gravelly loam, in an area of Bayard-Dix complex, 9 to 20 percent slopes, 1,900 feet south and 1,600 feet east of the northwest corner of sec. 22, T. 19 N., R. 57 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist;

weak fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

AC—7 to 15 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure; slightly hard, very friable; neutral; clear smooth boundary.

C—15 to 60 inches; pale brown (10YR 6/3) very gravelly coarse sand, brown (10YR 4/3) moist; single grain; loose; neutral.

The mollic epipedon ranges from 7 to 20 inches in thickness. The depth to gravelly sandy material ranges from 10 to 20 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically gravelly loam or sandy loam, but the range includes loamy coarse sand, gravelly sandy loam, and loam. The AC horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. It is gravelly loam or very gravelly sand. The C horizon has hue of 10YR or 7.5YR, value of 5 or 6 (4 to 6 moist), and chroma of 2 to 4. It is very gravelly coarse sand, very gravelly sand, or gravelly coarse sand.

Duroc Series

The Duroc series consists of deep, well drained, moderately permeable soils in upland swales and along drainageways. These soils formed in loamy alluvial and colluvial sediments. Slopes range from 0 to 3 percent.

Duroc soils are commonly near Alliance, Bridget, Keith, Rosebud, and Tripp soils. Alliance, Bridget, Keith, Rosebud, and Tripp soils do not have a pachic epipedon. They are higher on the landscape than the Duroc soils. Alliance, Keith, and Rosebud soils have a well developed subsoil. Alliance soils have sandstone bedrock at a depth of 40 to 60 inches. Bridget soils have less clay in the control section than the Duroc soils. They are on foot slopes. Rosebud soils have sandstone bedrock at a depth of 20 to 40 inches. Tripp soils have a horizon that has accumulations of secondary carbonates.

Typical pedon of Duroc loam, 1 to 3 percent slopes, 200 feet north and 1,500 feet west of the southeast corner of sec. 21, T. 18 N., R. 58 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A1—7 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

A2—16 to 25 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure; slightly hard, friable; neutral; clear smooth boundary.

AC—25 to 34 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure; slightly hard, friable; neutral; gradual smooth boundary.

C—34 to 60 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The thickness of the solum and of the mollic epipedon ranges from 20 to 50 inches. The depth to carbonates ranges from 10 to 36 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is loam or silt loam. Some pedons have a Bw horizon, which has colors intermediate between those of the A and C horizons. The C horizon has value of 5 to 8 (3 to 6 moist) and chroma of 2 to 4 (dry or moist). It is very fine sandy loam, loam, or silt loam.

Eckley Series

The Eckley series consists of well drained soils that are shallow over gravelly sediments. Permeability is moderate in the upper part of the profile and very rapid in the lower part. These soils are on ridgetops in the uplands and on side slopes. Slopes range from 3 to 30 percent.

Eckley soils are commonly near Alliance, Altvan, and Sidney soils. Alliance and Altvan soils are in landscape positions similar to those of the Eckley soils. Alliance soils have sandstone bedrock at a depth of 40 to 60 inches. Altvan soils have gravelly coarse sand at a depth of 20 to 40 inches. Sidney soils are deep over sandstone bedrock. They are lower on the landscape than the Eckley soils.

Typical pedon of Eckley gravelly sandy loam, 3 to 30 percent slopes, 900 feet east and 600 feet south of the northwest corner of sec. 35, T. 18 N., R. 53 W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; about 20 percent gravel, by volume; neutral; clear smooth boundary.

Bt—7 to 14 inches; dark brown (10YR 4/3) gravelly sandy clay loam, dark brown (10YR 3/3) moist; strong coarse subangular blocky structure; hard, firm; about 20 percent gravel, by volume; neutral; clear smooth boundary.

2C1—14 to 34 inches; brown (10YR 5/3) very gravelly

Figure 18.—A typical profile of Epping silt loam. The arrow indicates the depth to weathered siltstone bedrock. Depth is marked in feet.

sand, dark brown (10YR 4/3) moist; single grain; loose; about 40 percent gravel, by volume; neutral; clear wavy boundary.

2C2—34 to 60 inches; very pale brown (10YR 7/4) gravelly sand, pale brown (10YR 6/3) moist; single grain; loose; about 25 percent gravel, by volume; neutral.

The thickness of the solum and the depth to gravelly sand range from 12 to 20 inches. The content of gravel in the solum ranges from 10 to 35 percent, by volume.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically gravelly sandy loam, but the range includes gravelly loam and sandy loam. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 to 4. It is typically gravelly sandy clay loam, but the range includes sandy clay loam and clay loam. The 2C horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 or 4. It is very gravelly sand, gravelly sand, or gravelly loamy sand.

Epping Series

The Epping series consists of shallow, well drained and somewhat excessively drained, moderately permeable soils on uplands and valley foot slopes. These soils formed in material weathered from siltstone bedrock (fig. 18). Slopes range from 3 to 60 percent.

Epping soils are commonly near Bayard, Mitchell, Otero, and Tassel soils. Bayard, Mitchell, and Otero soils do not have siltstone bedrock within a depth of 60 inches. They are on foot slopes and alluvial fans below the Epping soils. Tassel soils have more sand in the control section than the Epping soils. They are higher on the landscape than the Epping soils.

Typical pedon of Epping silt loam, in an area of Mitchell-Epping complex, 9 to 20 percent slopes, 800 feet east and 950 feet north of the southwest corner of sec. 14, T. 18 N., R. 54 W.

A—0 to 4 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; moderately alkaline; clear smooth boundary.

AC—4 to 8 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

C—8 to 14 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline; abrupt irregular boundary.

Cr—14 to 60 inches; brown (7.5YR 5/4) siltstone bedrock, very pale brown (10YR 7/3) moist; strong effervescence.

The thickness of the solum ranges from 7 to 14 inches. The depth to carbonates ranges from 0 to 6 inches. The depth to siltstone bedrock ranges from 10 to 20 inches.

The A horizon has value of 6 or 7 (3 or 4 moist) and chroma of 2 or 3. It is typically silt loam, but the range includes very fine sandy loam and loam. The AC

horizon, if it occurs, has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is silt loam, loam, or very fine sandy loam. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3. It is silt loam, loam, or very fine sandy loam.

Glenberg Series

The Glenberg series consists of deep, well drained, moderately rapidly permeable soils on bottom land. These soils formed in calcareous, stratified loamy and sandy alluvium. Slopes range from 0 to 2 percent.

Glenberg soils are commonly near Bankard, Bayard, and Vetal soils. Bankard soils are sandy and excessively drained. They are in landscape positions similar to those of the Glenberg soils. Bayard and Vetal soils are higher on the landscape than the Glenberg soils. They are not stratified. Bayard soils have a dark surface soil that is thicker than that of the Glenberg soils. Vetal soils have a dark surface soil that is more than 20 inches thick.

Typical pedon of Glenberg very fine sandy loam, 0 to 2 percent slopes, 2,300 feet west and 450 feet north of the southeast corner of sec. 21, T. 19 N., R. 54 W.

A—0 to 6 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

C—6 to 60 inches; pale brown (10YR 6/3) very fine sandy loam that has thin lenses of loamy sand and fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; slight effervescence; moderately alkaline.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. It is typically very fine sandy loam, but the range includes sandy loam and fine sandy loam. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3. It is typically very fine sandy loam that has strata of loamy sand, loamy fine sand, loamy very fine sand, and fine sandy loam.

Goshen Series

The Goshen series consists of deep, well drained, moderately permeable soils in swales on uplands. These soils formed in colluvial and alluvial material derived from loess. Slopes are 0 to 1 percent.

Goshen soils are commonly near Alliance, Keith, Lodgepole, and Rosebud soils. Alliance, Keith, and Rosebud soils do not have a pachic epipedon. They are higher on the landscape than the Goshen soils. Alliance soils have sandstone bedrock at a depth of 40 to 60 inches. Rosebud soils have sandstone bedrock at a depth of 20 to 40 inches. Lodgepole soils are lower on the landscape than the Goshen soils. They are ponded after periods of heavy local rainfall.

Typical pedon of Goshen loam, 0 to 1 percent slopes, 2,450 feet north and 200 feet east of the southwest corner of sec. 22, T. 17 N., R. 55 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—7 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; neutral; clear smooth boundary.

Bt1—12 to 19 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; hard, firm; neutral; clear smooth boundary.

Bt2—19 to 32 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; hard, firm; mildly alkaline; clear smooth boundary.

Bt3—32 to 40 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; mildly alkaline; gradual wavy boundary.

C—40 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 35 to 60 inches. The depth to carbonates ranges from 34 to 60 inches. The thickness of the mollic epipedon ranges from 20 to 45 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam. The Bt horizon has value of 3 to 6 (2 to 5 moist) and chroma of 2 or 3. It is typically silty clay loam, but the range includes silt loam and loam. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam and very fine sandy loam.

Janise Series

The Janise series consists of deep, somewhat poorly drained, moderately slowly permeable soils on bottom land. These soils formed in loamy and sandy alluvium. Slopes range from 0 to 2 percent.

Janise soils are commonly near Glenberg, Lisco, Otero, and Yockey soils. Glenberg, Lisco, and Otero soils have a coarser texture than that of the Janise soils. Glenberg and Otero soils are mildly alkaline and moderately alkaline. They are higher on the landscape

than the Janise soils. Yockey soils do not have a very strongly alkaline B horizon. They are in landscape positions similar to those of the Janise soils.

Typical pedon of Janise loam, 0 to 2 percent slopes, 100 feet west and 2,250 feet south of the northeast corner of sec. 2, T. 19 N., R. 55 W.

E—0 to 2 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; slightly hard, very friable; strong effervescence; strongly alkaline; abrupt smooth boundary.

Bw—2 to 12 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; strong effervescence; very strongly alkaline; clear smooth boundary.

BC—12 to 18 inches; light brownish gray (10YR 6/2) loam, brownish gray (10YR 5/2) moist; weak medium subangular blocky structure; slightly hard, friable; strong effervescence; very strongly alkaline; clear smooth boundary.

C1—18 to 42 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; common distinct medium pale brown (10YR 6/3 moist) mottles; weak coarse subangular blocky structure; slightly hard, friable; strong effervescence; strongly alkaline; clear smooth boundary.

C2—42 to 60 inches; light gray (10YR 7/2) loamy very fine sand, brown (10YR 5/3) moist; soft, very friable; massive; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 24 inches. The depth to carbonates ranges from 0 to 6 inches.

The E horizon has value of 5 to 7 (3 or 4 moist) and chroma of 1 or 2. It is typically loam, but the range includes silt loam and very fine sandy loam. The B horizon has value of 6 or 7 (4 or 5 moist). It is typically loam, but the range includes silt loam and clay loam. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 or 3. It is loam or silt loam to a depth of 40 inches. The texture below a depth of 40 inches is typically loamy very fine sand or coarse sand, but the range includes loam.

Keith Series

The Keith series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 0 to 6 percent.

Keith soils are commonly near Alliance, Canyon, Goshen, and Rosebud soils. Alliance, Goshen, and Rosebud soils are lower on the landscape than the Keith soils. Alliance and Rosebud soils have sandstone bedrock at a depth of less than 60 inches. Goshen soils have a pachic epipedon. The shallow Canyon soils have less clay in the control section than the Keith soils. They are on ridgetops and the upper side slopes.

Typical pedon of Keith loam, 0 to 1 percent slopes, 1,600 feet east and 450 feet south of the northwest corner of sec. 2, T. 17 N., R. 57 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—6 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

Bt1—9 to 18 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; dark coatings of organic matter on faces of peds; moderate medium subangular blocky structure; hard, firm; neutral; clear smooth boundary.

Bt2—18 to 21 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; moderately alkaline; clear smooth boundary.

BC—21 to 29 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; slightly hard, friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C—29 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 48 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to carbonates ranges from 15 to 38 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loam, but the range includes silt loam and very fine sandy loam. The Bt horizon has value of 4 to 6 (2 to 5 moist) and chroma of 2 or 3. It is typically silty clay loam, but the range includes silt loam, clay loam, and loam. The BC horizon has value of 5 to 7 (3 to 6 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam and very fine sandy loam. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 to 4. It is typically very fine sandy loam, but the range includes silt loam and loam.

Lisco Series

The Lisco series consists of deep, somewhat poorly drained, moderately rapidly permeable soils on bottom

land. These soils formed in loamy alluvium that has been reworked by the wind in some places. Slopes range from 0 to 2 percent.

Lisco soils are commonly near Janise and Yockey soils. Janise and Yockey soils are silty. Yockey soils are stratified. They are in landscape positions similar to those of the Lisco soils.

Typical pedon of Lisco fine sandy loam, 0 to 2 percent slopes, 200 feet east and 700 feet north of the southwest corner of sec. 33, T. 20 N., R. 56 W.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

Bw—6 to 16 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium columnar structure; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C1—16 to 36 inches; light brownish gray (10YR 6/2) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; strong effervescence; strongly alkaline; gradual smooth boundary.

C2—36 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; strong effervescence; strongly alkaline.

The thickness of the solum ranges from 10 to 44 inches. The depth to free carbonates ranges from 0 to 10 inches.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It is typically fine sandy loam, but the range includes very fine sandy loam, loamy fine sand, and loam. Some pedons have an E horizon. This horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It is typically fine sandy loam, very fine sandy loam, or loam. The Bw horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. It is typically fine sandy loam, but the range includes loamy very fine sand, very fine sandy loam, and loam. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 1 to 3. It is typically fine sandy loam or loamy fine sand, but the range includes loam and sand. The sand is at a depth of more than 40 inches.

Lodgepole Series

The Lodgepole series consists of deep, somewhat poorly drained, very slowly permeable soils in upland depressions. These soils formed in loess. Slopes are 0 to 1 percent.

Lodgepole soils are commonly near Alliance, Goshen, Keith, and Rosebud soils. Alliance, Goshen, Keith, and Rosebud soils are better drained than the Lodgepole soils, have less clay in the subsoil, and are higher on the landscape.

Typical pedon of Lodgepole silt loam, 0 to 1 percent slopes, 700 feet east and 1,000 feet south of the northwest corner of sec. 12, T. 17 N., R. 56 W.

Ap—0 to 5 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

Bt1—5 to 9 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

Bt2—9 to 31 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; common fine and medium prominent reddish brown (5YR 4/4 moist) mottles; strong fine and medium angular blocky structure; very hard, very firm; neutral; clear smooth boundary.

BC—31 to 49 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, very friable; neutral; gradual smooth boundary.

C—49 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; neutral.

The thickness of the solum ranges from 27 to 56 inches. The depth to carbonates ranges from 24 to more than 60 inches. The mollic epipedon ranges from 20 to 41 inches in thickness. It extends into the B horizon.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, but the range includes very fine sandy loam and loam. Some pedons have an E horizon. The Bt horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is silty clay or silty clay loam. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 to 4. It is typically silt loam or sandy loam, but the range includes loamy sand, fine sandy loam, very fine sandy loam, and loam.

Mitchell Series

The Mitchell series consists of deep, well drained, moderately permeable soils on foot slopes and alluvial fans. These soils formed in loamy colluvial and alluvial sediments that weathered from siltstone bedrock. Slopes range from 0 to 20 percent.

Mitchell soils are commonly near Bridget, Epping, and Otero soils. Bridget soils have a mollic epipedon. Otero soils are coarse loamy. Epping soils are shallow to siltstone bedrock. They are higher on the landscape than the Mitchell soils.

Typical pedon of Mitchell very fine sandy loam, 0 to 1 percent slopes, 400 feet west and 200 feet south of the northeast corner of sec. 7, T. 18 N., R. 53 W.

Ap—0 to 7 inches; pale brown (10YR 6/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

AC—7 to 12 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C—15 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, yellowish brown (10YR 6/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The depth to carbonates ranges from 0 to 10 inches.

The A, AC, and C horizons are typically very fine sandy loam, but the range includes loam and silt loam. The A horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. The AC and C horizons have value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3.

Otero Series

The Otero series consists of deep, well drained, moderately rapidly permeable soils on foot slopes and alluvial fans. These soils formed in sandy and loamy sediments that have been reworked by the wind in some places. Slopes range from 0 to 35 percent.

Otero soils are commonly near Bridget, Mitchell, Sarben, and Valent soils. Bridget and Mitchell soils are in landscape positions similar to those of the Otero soils. Bridget soils have a mollic epipedon and are coarse silty. Mitchell soils have less sand in the control section than the Otero soils. Sarben soils have carbonates at a depth of more than 24 inches. They are higher on the landscape than the Otero soils. Valent soils are sandy and are on dunes.

Typical pedon of Otero loamy very fine sand, 3 to 9 percent slopes, 300 feet east and 400 feet south of the northwest corner of sec. 25, T. 20 N., R. 58 W.

Ap—0 to 5 inches; brown (10YR 5/3) loamy very fine sand, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

AC—5 to 12 inches; pale brown (10YR 6/3) loamy very fine sand, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C1—12 to 21 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—21 to 60 inches; very pale brown (10YR 7/3) loamy very fine sand, pale brown (10YR 6/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

Free carbonates are typically at the surface but range to a depth of 10 inches in some pedons.

The A horizon has value of 5 to 7 (3 to 6 moist) and chroma of 2 to 4. It is typically loamy very fine sand, but the range includes very fine sandy loam, loamy fine sand, and loam. The AC horizon has value of 6 to 8 (4 or 5 moist) and chroma of 2 or 3. It is typically loamy very fine sand, but the range includes very fine sandy loam and fine sandy loam. The C horizon has value of 6 or 7 (5 or 6 moist). It is typically loamy very fine sand, but the range includes fine sandy loam and very fine sandy loam.

Rosebud Series

The Rosebud series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loamy material weathered from calcareous sandstone bedrock (fig. 19). Slopes range from 1 to 6 percent.

The Rosebud soils in the county are taxadjuncts to the series because they have less than 15 percent fine sand and coarser sand. This difference, however, does not significantly affect the use and management of the soils.

Rosebud soils are commonly near Alliance, Canyon, Duroc, and Sidney soils. Alliance soils have sandstone bedrock at a depth of 40 to 60 inches. They are in landscape positions similar to those of the Rosebud soils. Canyon soils are shallow over sandstone bedrock. They are on upland ridgetops and side slopes. Duroc soils have a pachic epipedon. They are on foot slopes and in upland swales. Sidney soils do not have an argillic horizon. They are higher on the landscape than the Rosebud soils.

Typical pedon of Rosebud loam, 1 to 3 percent slopes, 250 feet east and 1,450 feet south of the northwest corner of sec. 33, T. 17 N., R. 56 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; moderately alkaline; abrupt smooth boundary.

Bt1—7 to 11 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure, hard,

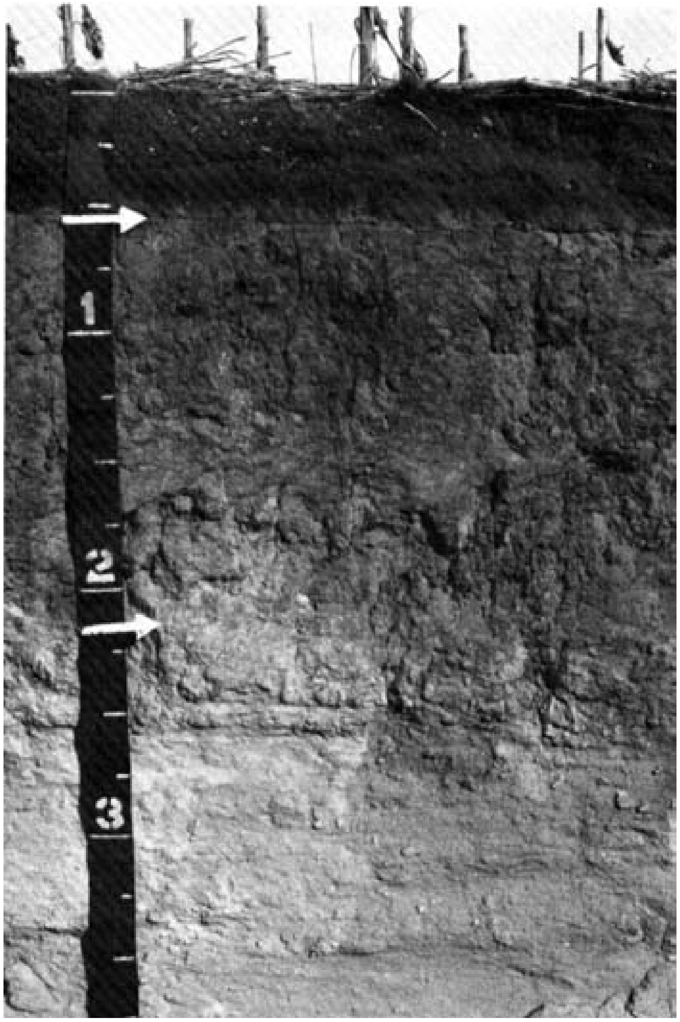

Figure 19.—A typical profile of Rosebud loam. The upper arrow indicates the lower boundary of the plow layer. The lower arrow indicates the depth to sandstone bedrock. Depth is marked in feet.

firm; moderately alkaline; clear smooth boundary.

Bt2—11 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm; moderately alkaline; abrupt wavy boundary.

Bk—17 to 20 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, firm; strong effervescence; moderately alkaline; clear smooth boundary.

C1—20 to 24 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; strong effervescence; strongly alkaline; gradual smooth boundary.

C2—24 to 38 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable; strong effervescence; strongly alkaline; abrupt wavy boundary.

Cr—38 to 60 inches; white (10YR 8/2), weakly cemented, fine grained sandstone bedrock; violent effervescence; strongly alkaline.

The thickness of the solum ranges from 12 to 26 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. The depth to free carbonates ranges from 9 to 30 inches. The depth to sandstone bedrock ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but the range includes silt loam and very fine sandy loam. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is typically clay loam, but the range includes loam. The Bk horizon has value of 6 or 7 (4 to 6 moist) and chroma of 2 or 3. It is typically loam, but the range includes clay loam. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 3 or 4. It is typically loam, but the range includes sandy loam and very fine sandy loam.

Sarben Series

The Sarben series consists of deep, well drained, moderately rapidly permeable soils on uplands and stream terraces. These soils formed in loamy eolian material. Slopes range from 0 to 9 percent.

Sarben soils are commonly near Alice, Otero, and Valent soils. Alice soils have a mollic epipedon. They are in landscape positions similar to those of the Sarben soils. Otero soils typically have carbonates at the surface. They are lower on the landscape than the Sarben soils. Valent soils are sandy and are on dunes.

Typical pedon of Sarben loamy very fine sand, 3 to 9 percent slopes, 600 feet west and 600 feet north of the southeast corner of sec. 2, T. 19 N., R. 54 W.

A—0 to 7 inches; brown (10YR 5/3) loamy very fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—7 to 16 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 5/3) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C1—16 to 29 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; mildly alkaline; clear smooth boundary.

C2—29 to 60 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; slight effervescence; moderately alkaline.

The depth to carbonates ranges from 15 to 40 inches.

The A, AC, and C horizons are typically loamy very fine sand, but the range includes fine sandy loam and very fine sandy loam. The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The C horizon has value of 5 to 8 (4 to 6 moist) and chroma of 2 or 3.

Satanta Series

The Satanta series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy eolian material. Slopes range from 1 to 6 percent.

Satanta soils are commonly near Alliance, Altvan, Keith, and Rosebud soils. Alliance, Altvan, and Rosebud soils are lower on the landscape than the Satanta soils. Alliance soils are fine silty and have sandstone bedrock at a depth of 40 to 60 inches. Altvan soils are 20 to 40 inches deep over gravelly coarse sand. Keith soils are fine silty. They are in landscape positions similar to those of the Satanta soils. Rosebud soils have sandstone bedrock at a depth of 20 to 40 inches.

Typical pedon of Satanta fine sandy loam, 1 to 3 percent slopes, 350 feet north and 50 feet west of the southeast corner of sec. 8, T. 17 N., R. 58 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

Bt1—5 to 11 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, firm; neutral; clear smooth boundary.

Bt2—11 to 18 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm; mildly alkaline; gradual wavy boundary.

Bk—18 to 25 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, friable; strong effervescence; films and threads of segregated lime; moderately alkaline; gradual smooth boundary.

C1—25 to 47 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—47 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; strong effervescence; about 3 percent gravel, by volume; moderately alkaline.

The thickness of the solum ranges from 18 to 40 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. The depth to carbonates ranges from 15 to 36 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is fine sandy loam, very fine sandy loam, or loam. The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. It is typically sandy clay loam, but the range includes loam and clay loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is dominantly fine sandy loam, very fine sandy loam, or loam but commonly grades to sandy material below a depth of 40 inches. The content of gravel in the C horizon is less than 5 percent, by volume.

Sidney Series

The Sidney series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy, calcareous material. Slopes range from 3 to 20 percent.

Sidney soils are commonly near Alliance, Canyon, Keith, and Rosebud soils. Alliance, Keith, and Rosebud soils have more clay in the subsoil than the Sidney soils. Alliance and Rosebud soils are lower on the landscape than the Sidney soils. Keith soils are in landscape positions similar to those of the Sidney soils. Rosebud soils have sandstone bedrock at a depth of 20 to 40 inches. Canyon soils have sandstone bedrock at a depth of less than 20 inches. They are on ridgetops.

Typical pedon of Sidney loam, in an area of Sidney-Canyon loams, 3 to 6 percent slopes, 2,500 feet east and 1,700 feet north of the southwest corner of sec. 10, T. 17 N., R. 55 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

Bw—7 to 16 inches; brown (10YR 5/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

Bk—16 to 26 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; slightly hard, very friable; violent effervescence; moderately alkaline; clear wavy boundary.

C—26 to 48 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

Cr—48 to 60 inches; white (10YR 8/2), weakly cemented, calcareous, fine grained sandstone bedrock, light gray (10YR 7/2) moist; violent effervescence; strongly alkaline.

The solum ranges from 7 to 30 inches in thickness. Carbonates are typically at the surface but range to a depth of 18 inches. The mollic epipedon ranges from 7 to 20 inches in thickness. The depth to sandstone bedrock ranges from 40 to 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically loam, but the range includes very fine sandy loam and fine sandy loam. The Bw horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is loam, very fine sandy loam, or fine sandy loam. The Bk horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is silt loam, loam, very fine sandy loam, or fine sandy loam. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 or 3. It is loam, very fine sandy loam, fine sandy loam, or sandy loam.

The Sidney soils in Canyon-Sidney loams, 9 to 20 percent slopes, eroded, and Sidney-Canyon loams, 6 to 9 percent slopes, eroded, do not have the mollic epipedon that is definitive for the Sidney series. This difference, however, does not significantly affect the use and management of the soils.

Tassel Series

The Tassel series consists of shallow, well drained and somewhat excessively drained, moderately rapidly permeable soils on uplands. These soils formed in loamy and sandy material weathered from sandstone bedrock. Slopes range from 9 to 60 percent.

Tassel soils are commonly near Busher soils in the landscape. Busher soils are deep over sandstone bedrock, have a mollic epipedon, and are lower on the landscape than the Tassel soils.

Typical pedon of Tassel loamy very fine sand, in an area of Tassel-Rock outcrop complex, 20 to 60 percent slopes, 2,300 feet west and 500 feet north of the southeast corner of sec. 15, T. 18 N., R. 53 W.

A—0 to 7 inches; pale brown (10YR 6/3) loamy very fine sand, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; abundant fibrous roots; about 14 percent soft sandstone pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

C—7 to 15 inches; pale brown (10YR 6/3) loamy very fine sand, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable; common fibrous roots; about 19 percent soft sandstone pebbles; strong effervescence; mildly alkaline; abrupt wavy boundary.

Cr—15 to 23 inches; white (10YR 8/2), weakly cemented, fine grained sandstone bedrock, light gray (10YR 7/2) moist; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 0 to 3 inches. The depth to sandstone bedrock ranges from 6 to 20 inches.

The A horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 to 4. It is typically loamy very fine sand, but the range includes very fine sandy loam, fine sandy loam, and loamy fine sand. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 or 3. It is typically loamy very fine sand, but the range includes loamy fine sand, fine sandy loam, and sandy loam. It has less than 12 percent clay.

Tripp Series

The Tripp series consists of deep, well drained, moderately permeable soils on stream terraces. These soils formed in loamy alluvium and loess. Slopes range from 0 to 9 percent.

Tripp soils are commonly near Alice, Bridget, and Mitchell soils. Alice soils have more sand than the Tripp soils. They are in landscape positions similar to those of the Tripp soils. Bridget soils do not have a well developed subsoil. They are on foot slopes and alluvial fans. Mitchell soils have carbonates that are higher in the profile than those of the Tripp soils. They do not have a mollic epipedon. They are lower on the landscape than the Tripp soils.

Typical pedon of Tripp very fine sandy loam, 1 to 3 percent slopes, 150 feet north and 150 feet east of the southwest corner of sec. 23, T. 19 N., R. 54 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A—7 to 12 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.

Bw—12 to 21 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; slightly hard, very friable; neutral; clear smooth boundary.

Bk—21 to 30 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; slightly hard, very friable; threadlike accumulations of carbonates; violent effervescence; moderately alkaline; clear wavy boundary.

C—30 to 60 inches; very pale brown (10YR 7/3) very

fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 48 inches. The depth to carbonates ranges from 18 to 40 inches. The mollic epipedon ranges from 7 to 20 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is typically very fine sandy loam or loamy very fine sand, but the range includes loam and silt loam. The B horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is typically very fine sandy loam, but the range includes silt loam and loam. The Bk horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3. It is typically silt loam, but the range includes very fine sandy loam and loam. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3. It is very fine sandy loam or loam.

Valent Series

The Valent series consists of deep, excessively drained, rapidly permeable soils on uplands. These soils formed in sandy eolian material. Slopes range from 0 to 24 percent.

Valent soils are commonly near Sarben soils. Sarben soils are coarse loamy and are lower on the landscape than the Valent soils.

Typical pedon of Valent loamy fine sand, 3 to 9 percent slopes, 1,050 feet east and 1,320 feet south of the northwest corner of sec. 20, T. 19 N., R. 53 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—4 to 10 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C—10 to 60 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; mildly alkaline.

The depth to carbonates ranges from 40 to more than 60 inches.

The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 or 3. It is typically loamy fine sand or fine sand, but the range includes loamy sand and sand. The AC and C horizons are sand, fine sand, loamy sand, or loamy fine sand. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4.

Vetal Series

The Vetal series consists of deep, well drained, moderately rapidly permeable soils on foot slopes and in swales. These soils formed in loamy and sandy sediments. Slopes range from 0 to 6 percent.

Vetal soils are commonly near Alice, Bayard, Creighton, Satanta, and Valent soils. Alice, Bayard, Creighton, Satanta, and Valent soils are higher on the landscape than the Vetal soils. Alice, Bayard, Creighton, and Satanta soils have a mollic epipedon less than 20 inches thick. Bayard soils have carbonates at a depth of less than 20 inches. Satanta soils are fine loamy. Valent soils are sandy. They are on dunes.

Typical pedon of Vetal fine sandy loam, 3 to 6 percent slopes, 700 feet north and 1,500 feet east of the southwest corner of sec. 33, T. 18 N., R. 58 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A—7 to 14 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

AC—14 to 36 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; soft, very friable; mildly alkaline; gradual wavy boundary.

C—36 to 60 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable; mildly alkaline.

The thickness of the solum ranges from 24 to 60 inches. The thickness of the mollic epipedon ranges from 20 to 50 inches. Typically, the profile does not have carbonates throughout, but some pedons have carbonates below a depth of 30 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically fine sandy loam or very fine sandy loam, but the range includes loamy very fine sand. The AC horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is typically fine sandy loam or very fine sandy loam, but the range includes loam and sandy loam. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is typically fine sandy loam or very fine sandy loam, but the range includes sandy loam, loamy fine sand, and loamy very fine sand.

Yockey Series

The Yockey series consists of deep, somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in stratified, loamy and sandy alluvium. Slopes range from 0 to 2 percent.

Yockey soils are commonly near Glenberg and Janise soils. Glenberg soils are well drained. They have more sand in the control section than the Yockey soils.

Also, they are higher on the landscape. Janise soils have a very strongly alkaline B horizon. They are in landscape positions similar to those of the Yockey soils.

Typical pedon of Yockey loam, alkali, 0 to 2 percent slopes, 1,700 feet east and 2,200 feet north of the southwest corner of sec. 23, T. 19 N., R. 53 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

AC—6 to 18 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable; strong effervescence; very strongly alkaline; clear smooth boundary.

C1—18 to 32 inches; light brownish gray (10YR 6/2) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; strong effervescence; very strongly alkaline; clear smooth boundary.

C2—32 to 60 inches; stratified light gray (10YR 7/2) and light brownish gray (10YR 6/2) very fine sandy loam, brown (10YR 5/3) and dark grayish brown (10YR 4/2) moist; few fine distinct reddish yellow (7.5YR 6/6 moist) mottles; massive; soft, very friable; strong effervescence; very strongly alkaline.

The thickness of the solum ranges from 4 to 22 inches. Carbonates are typically at the surface but may be leached to a depth of 10 inches in some pedons.

The A horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is typically loam, but the range includes sandy loam, fine sandy loam, and silt loam. The AC horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3. It is typically very fine sandy loam, but the range includes loamy very fine sand, loam, and silt loam. Some pedons do not have an AC horizon. The C horizon has value of 6 to 8 (4 to 6 moist) and chroma of 2 or 3. It dominantly is very fine sandy loam, loam, or silt loam. In some pedons it ranges from fine sandy loam to gravelly loamy very fine sand below a depth of 40 inches.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. Soil forms in gradual and indistinct stages. The characteristics of a soil are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, mainly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other factors. The process of soil formation and development is continuous.

Parent Material

Parent material is the unconsolidated mineral material in which a soil forms. The soils in Banner County formed in loess, in material weathered from bedrock, in alluvium, in mixed alluvium and colluvium, and in sandy eolian material.

Loess is one of the more extensive parent materials in the county. It is silty, calcareous material on tablelands and in places on stream terraces. It is typically a very pale brown deposit that ranges to 5 feet or more in thickness. Keith soils formed in loess.

Another major parent material in the county is material that weathered from sandstone and siltstone formations. The soils formed in place, or they formed in material that was locally reworked and transported by wind. The thickness of the deposits ranges from just a few inches to several feet. With the exception of the dark surface layer, most soils that formed in material weathered from sandstone and siltstone have weakly expressed horizons.

Busher, Canyon, and Tassel soils formed in material weathered from sandstone bedrock. Epping and Mitchell soils formed in material weathered from siltstone bedrock. Some of the soils weathered from bedrock often contain varying amounts of volcanic ash.

Alluvium is material that has been deposited by moving water. It consists of sand, silt, clay, and gravel washed from the higher local areas and from the mountain regions to the west. This alluvial material is deposited on bottom land and stream terraces of the major streams and adjacent drainageways. The thickness of these deposits ranges from shallow layers of gravel to thick layers of sandy and loamy material. Bankard and Glenberg soils formed in recent alluvium that is in narrow drainageways and along the major streams where materials are deposited by flooding. Alice and Tripp soils formed in alluvium on stream terraces. Janise, Lisco, and Yockey soils formed in alluvium on bottom land. Altvan and Eckley soils formed in loamy and gravelly sediments deposited on stream terraces and uplands.

Mixed alluvium and colluvium has been deposited by the combined forces of gravity and water. It consists of material that has been moved from the higher areas and redeposited on foot slopes at the base of hills and along small drainageways of swales. Soils that formed in this material have a dark surface layer and weakly expressed horizons. Bayard, Bridget, Duroc, and Vetal soils formed in this material.

Sandy eolian material has been deposited by the wind on dunes and on valley terraces. With the exception of a somewhat dark surface layer, soils that formed in sandy eolian material show little horizon development. Valent soils formed in sandy eolian material. Most of the material in the Otero and Sarben soils weathered from bedrock and has been locally reworked by wind as eolian material.

In many areas of the county, soils formed in a

mixture of different soil materials or in areas where young material was deposited over older material. Alliance, Creighton, Goshen, Rosebud, Satanta, and Sidney soils formed in more than one type of parent material.

Climate

Climate affects the formation of soils through its influence on the rate that rainfall, temperature, and wind weather and rework the parent material. Because soils form slowly when dry, soils in arid regions generally are less well developed than those in humid regions. The amount of moisture, the length of the growing season, and the prevailing temperature during the growing season affect the amount of vegetation, which is the principal source of organic matter in soils. These factors also directly affect the activity of the micro-organisms that convert organic matter to humus. Wind can remove the surface layer of the soil or can deposit a mantle of sediment on it.

Banner County has a semiarid, continental climate that is characterized by wide daily and seasonal variations. The average annual temperature is about 46 degrees F. The average annual precipitation is about 14 inches. The frost-free growing season averages about 125 days, which is an adequate growing season for most common grain crops and forage crops. The prevailing wind is from the west or west-northwest from October through April. The windspeed is highest in the spring.

Wind has had an effect on many soils in the county. The accumulations of sand and loess are examples of eolian deposition. Many deposits of eolian material are aligned with the prevailing wind direction. Hot winds in the summer can dry the soil. The physical properties of a soil can be changed by wind action that removes the entire surface layer or deposits soil material.

Plant and Animal Life

After the parent material was deposited, bacteria, fungi, and other simple forms of plant and animal life invaded the parent material. After a time, more complex forms of life began to develop. Plants and animals living on and in the soil produce organic matter, which influences the physical and chemical properties of the soil. The other soil-forming factors affect the kinds and amounts of plants and animals.

The soils of the county formed under a short grass prairie. The decomposition of plants and their roots provides the soil with organic matter. The fibrous roots of the grasses penetrate the soil and help to form a friable surface layer and a permeable subsoil, which enhance the flow of water into the soil and increase soil porosity. The increased porosity improves soil aeration and stimulates the activity of bacteria and burrowing animals.

Worms and small burrowing animals mix the soil material with organic matter. This activity speeds soil development, increases friability, and helps to aerate the soil.

Micro-organisms break down plant residue, forming humus. When micro-organisms die, they become a source of nutrients for plants.

Human activities have removed the cover of prairie grasses and exposed the fertile surface layer, which causes accelerated erosion. Cultural farming practices and applications of fertilizers, minerals, and pesticides have altered the physical and biological characteristics of the soils.

Relief

Relief influences soil formation mainly through its effect on drainage, runoff, and plant growth. The slope, the shape of the surface, and the permeability of the soil determine the rate of runoff, the internal drainage, and the moisture content of the soil. Internal drainage and availability of moisture are important factors in the development of soil horizons.

The nearly level to gently sloping soils on uplands are more strongly developed and have more distinct horizons than the steeper soils. They absorb more moisture and have less runoff, and water percolates deeper into the profile. Consequently, more lime, plant nutrients, and clay particles are leached in these soils and well developed and distinct horizons form. The nearly level and gently sloping Alliance, Keith, Rosebud, and Satanta soils have fairly well developed profiles.

In the steeper areas where runoff is rapid and little moisture penetrates the soil, development of the soil is slower than in the less sloping areas. Erosion removes the surface soil almost as fast as it forms. Lime and other elements are not leached to so great a depth as they are in the less sloping soils. In Banner County, Canyon and Tassel soils show little profile development other than a slightly darkened, thin surface layer.

Runoff is slow on soils in upland depressions. These soils receive runoff from the higher surrounding areas. Because of the extra moisture, these soils have a thick, dark surface layer and good horizon development. Scott Variant and Goshen soils are examples of these soils.

Soils on bottom land have very low relief. Some of these soils have a seasonal high water table, which affects the decomposition of organic matter, the soil temperature, and the degree of alkalinity. Other soils on bottom land are subject to flooding and to continuous deposition of sediment. Bankard and Glenberg soils are well drained bottom-land soils. Janise, Lisco, and

Yockey soils are bottom-land soils that are affected by the degree of alkalinity and by a seasonal high water table.

The nearly level to gently sloping soils on stream terraces have distinct soil horizons. Generally, the lime is leached from the normal root zone. Alice and Tripp soils have a moderate degree of horizon development.

Runoff is slow on the rolling soils in the sandhills. These soils are excessively drained and rapidly permeable. Carbonates have been very deeply leached. Soil horizons are weakly developed and indistinct because the coarse sandy material is highly resistant to chemical weathering. Valent soils are an example of weakly developed soils.

Time

Time is needed for relief, climate, and plant and animal life to form the soils from parent material. In areas where parent material has been in place or has been exposed for only a short time, the soil-forming factors have not had time to act on the soil material. In Banner County, Alliance, Keith, Rosebud, and Satanta soils are mature soils with well expressed horizons.

Soils that formed on stream terraces have a more well defined sequence of genetic horizons than the soils that formed on bottom land. Alice and Tripp soils are on stream terraces. Bankard and Glenberg soils are on bottom land where the alluvium has not been in place long enough for these soils to form distinct horizons.

The degree of profile development depends on the intensity of the soil-forming factors, the length of time that the factors have been active, and the nature of the parent material. Differences in the length of time that geologic material has been in place are commonly proportional to the degree of horizon distinction.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boot stage. The time in the growth of grasses when the flowering head is in the upper sheaf, just prior to emergence.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Carrying capacity. The maximum stocking rate that can be used without damaging the vegetation or related resources.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2

millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser

depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made

by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by the wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Organic matter content. The amount of organic matter in the soil. The classes used in this survey are very low, less than 0.5 percent; low, 0.5 to 1.0 percent; moderately low, 1.0 to 2.0 percent; moderate, 2.0 to 4.0 percent; and high, 4.0 to 8.0 percent.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Planned grazing system. A system in which two or more units of grazing land are alternately rested

and grazed in a planned sequence over a period of years.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. The removal of not more than 50 percent, by weight, of the key management plants when an area of range or pasture is grazed. Proper grazing use protects the surface by maintaining an adequate plant cover. It also maintains or improves the quality and quantity of desirable vegetation.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey area the classes of slope are:

Nearly level	0 to 1 percent, 0 to 2 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 6 percent
Stongly sloping	6 to 9 percent
Moderately steep	9 to 20 percent
Steep	20 to 30 percent
Very steep	30 to 60 percent
Rolling	9 to 24 percent
Hilly	more than 24 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stocking rate. The number of livestock per unit of grazing land.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It

includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Harrisburg, Nebraska)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	36.3	9.6	23.0	62	-28	25	0.38	0.15	0.58	2	7.8
February	42.5	16.0	29.3	68	-15	17	.30	.10	.46	1	6.0
March	47.6	21.1	34.4	76	-10	68	.83	.30	1.27	3	10.7
April	58.9	30.6	44.8	83	6	188	1.47	.73	2.09	4	6.4
May	68.2	39.7	54.0	89	24	434	2.76	1.28	4.02	7	1.0
June	78.5	48.9	63.7	98	31	711	2.33	1.13	3.37	5	.0
July	86.5	55.5	71.0	100	42	961	1.99	.72	3.04	5	.0
August	84.5	51.9	68.2	98	35	874	1.28	.37	2.00	4	.0
September	74.9	42.1	58.5	93	22	555	.97	.19	1.57	3	.1
October	64.2	30.7	47.5	86	8	258	.74	.21	1.15	2	2.4
November	49.5	20.4	35.0	74	-8	40	.48	.13	.75	2	5.9
December	41.1	13.4	27.3	69	-20	16	.35	.10	.55	1	6.9
Yearly:											
Average	61.1	31.7	46.4	---	---	---	---	---	---	---	---
Extreme	---	---	---	100	-28	---	---	---	---	---	---
Total	---	---	---	---	---	4,147	13.88	10.78	16.79	39	47.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Harrisburg, Nebraska)

Probability	Temperature: 24 °F or lower	Temperature: 28 °F or lower	Temperature: 32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 9	May 24	June 8
2 years in 10 later than--	May 4	May 18	June 2
5 years in 10 later than--	Apr. 24	May 6	May 22
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 17	Sept. 14	Aug. 31
2 years in 10 earlier than--	Sept. 23	Sept. 18	Sept. 6
5 years in 10 earlier than--	Oct. 3	Sept. 27	Sept. 17

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Harrisburg, Nebraska)

Probability	Daily minimum temperature during growing season: Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	140	121	94
8 years in 10	147	128	101
5 years in 10	161	143	117
2 years in 10	175	157	132
1 year in 10	182	164	140

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AcB	Alice fine sandy loam, 0 to 3 percent slopes	5,700	1.2
AcC	Alice fine sandy loam, 3 to 6 percent slopes	7,300	1.5
AcD	Alice fine sandy loam, 6 to 9 percent slopes	2,750	0.6
Ae	Alliance loam, 0 to 1 percent slopes	6,200	1.3
AeB	Alliance loam, 1 to 3 percent slopes	21,600	4.4
AeC	Alliance loam, 3 to 6 percent slopes	7,200	1.5
AeD2	Alliance loam, 6 to 9 percent slopes, eroded	920	0.2
AgC	Altvan loam, 3 to 6 percent slopes	620	0.1
AhD	Altvan-Eckley complex, 3 to 9 percent slopes	6,500	1.4
Bb	Bankard loamy fine sand, 0 to 2 percent slopes	2,650	0.6
Bc	Bankard fine sand, channeled	5,200	1.1
BdB	Bayard very fine sandy loam, 1 to 3 percent slopes	13,400	2.8
BdC	Bayard very fine sandy loam, 3 to 6 percent slopes	11,300	2.4
BdD	Bayard very fine sandy loam, 6 to 9 percent slopes	4,050	0.8
BdE	Bayard very fine sandy loam, 9 to 20 percent slopes	2,400	0.5
BeD	Bayard-Dix complex, 3 to 9 percent slopes	7,100	1.5
BeE	Bayard-Dix complex, 9 to 20 percent slopes	8,700	1.8
Bg	Bridget very fine sandy loam, 0 to 1 percent slopes	5,400	1.1
BgB	Bridget very fine sandy loam, 1 to 3 percent slopes	10,700	2.2
BgC	Bridget very fine sandy loam, 3 to 6 percent slopes	5,200	1.1
BgD	Bridget very fine sandy loam, 6 to 9 percent slopes	1,700	0.4
BgE	Bridget very fine sandy loam, 9 to 20 percent slopes	740	0.2
BxE	Busher-Tassel loamy very fine sands, 9 to 20 percent slopes	11,200	2.3
CaF	Canyon loam, 9 to 30 percent slopes	5,000	1.0
CgG	Canyon-Rock outcrop complex, 20 to 60 percent slopes	8,200	1.7
CnE	Canyon-Sidney loams, 9 to 20 percent slopes	17,100	3.5
CnE2	Canyon-Sidney loams, 9 to 20 percent slopes, eroded	2,400	0.5
CrB	Creighton very fine sandy loam, 1 to 3 percent slopes	320	0.1
CrC	Creighton very fine sandy loam, 3 to 6 percent slopes	1,750	0.4
DtB	Dix sandy loam, 0 to 3 percent slopes	570	0.1
Dw	Duroc loam, 0 to 1 percent slopes	1,900	0.4
DwB	Duroc loam, 1 to 3 percent slopes	7,100	1.5
EcF	Eckley gravelly sandy loam, 3 to 30 percent slopes	9,600	2.0
EkF	Epping silt loam, 9 to 30 percent slopes	5,600	1.2
Gg	Glenberg very fine sandy loam, 0 to 2 percent slopes	1,600	0.3
Go	Goshen loam, 0 to 1 percent slopes	2,600	0.5
Ja	Janise loam, 0 to 2 percent slopes	1,950	0.4
Ke	Keith loam, 0 to 1 percent slopes	5,900	1.2
KeB	Keith loam, 1 to 3 percent slopes	10,500	2.2
KeC	Keith loam, 3 to 6 percent slopes	3,220	0.7
Lc	Lisco fine sandy loam, 0 to 2 percent slopes	1,150	0.2
Lo	Lodgepole silt loam, 0 to 1 percent slopes	268	0.1
Mt	Mitchell very fine sandy loam, 0 to 1 percent slopes	1,750	0.4
MtB	Mitchell very fine sandy loam, 1 to 3 percent slopes	2,300	0.5
MtC	Mitchell very fine sandy loam, 3 to 6 percent slopes	4,600	1.0
MtD	Mitchell very fine sandy loam, 6 to 9 percent slopes	3,500	0.7
MxD	Mitchell-Epping complex, 3 to 9 percent slopes	2,050	0.4
MxE	Mitchell-Epping complex, 9 to 20 percent slopes	10,000	2.1
OfB	Otero loamy very fine sand, 0 to 3 percent slopes	11,900	2.5
OfD	Otero loamy very fine sand, 3 to 9 percent slopes	6,100	1.3
OfE	Otero loamy very fine sand, 9 to 20 percent slopes	3,300	0.7
OvG	Otero-Epping complex, 9 to 60 percent slopes	2,850	0.6
RaG	Rock outcrop-Epping complex, 20 to 60 percent slopes	3,800	0.8
RbB	Rosebud loam, 1 to 3 percent slopes	2,850	0.6
RcC	Rosebud-Canyon loams, 3 to 6 percent slopes	9,350	2.0
SaB	Sarben loamy very fine sand, 0 to 3 percent slopes	6,800	1.4
SaD	Sarben loamy very fine sand, 3 to 9 percent slopes	8,600	1.8
StB	Satanta fine sandy loam, 1 to 3 percent slopes	10,000	2.1
SvC	Satanta-Altvan complex, 3 to 6 percent slopes	8,400	1.8
SxC	Sidney-Canyon loams, 3 to 6 percent slopes	8,550	1.8
SxD	Sidney-Canyon loams, 6 to 9 percent slopes	6,200	1.3
SxD2	Sidney-Canyon loams, 6 to 9 percent slopes, eroded	10,900	2.3
TcG	Tassel-Busher-Rock outcrop complex, 20 to 60 percent slopes	30,250	6.2
TfG	Tassel-Rock outcrop complex, 20 to 60 percent slopes	18,300	3.8
ToB	Tripp loamy very fine sand, overblown, 0 to 3 percent slopes	6,200	1.3

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
ToC	Tripp loamy very fine sand, overblown, 3 to 6 percent slopes	420	0.1
Tr	Tripp very fine sandy loam, 0 to 1 percent slopes	5,200	1.1
TrB	Tripp very fine sandy loam, 1 to 3 percent slopes	10,600	2.2
TrC	Tripp very fine sandy loam, 3 to 6 percent slopes	6,550	1.4
TrD	Tripp very fine sandy loam, 6 to 9 percent slopes	1,700	0.4
VaD	Valent fine sand, 3 to 9 percent slopes	2,300	0.5
VaE	Valent fine sand, rolling	4,850	1.0
VdB	Valent loamy fine sand, 0 to 3 percent slopes	6,200	1.3
VdD	Valent loamy fine sand, 3 to 9 percent slopes	13,500	2.8
VnC	Vetal fine sandy loam, 3 to 6 percent slopes	380	0.1
VtB	Vetal very fine sandy loam, 0 to 3 percent slopes	10,900	2.3
Yp	Yockey loam, alkali, 0 to 2 percent slopes	1,800	0.4
	Total	478,208	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
AcB	Alice fine sandy loam, 0 to 3 percent slopes (where irrigated)
AcC	Alice fine sandy loam, 3 to 6 percent slopes (where irrigated)
Ae	Alliance loam, 0 to 1 percent slopes (where irrigated)
AeB	Alliance loam, 1 to 3 percent slopes (where irrigated)
AeC	Alliance loam, 3 to 6 percent slopes (where irrigated)
AgC	Altvan loam, 3 to 6 percent slopes (where irrigated)
BdB	Bayard very fine sandy loam, 1 to 3 percent slopes (where irrigated)
BdC	Bayard very fine sandy loam, 3 to 6 percent slopes (where irrigated)
Bg	Bridget very fine sandy loam, 0 to 1 percent slopes (where irrigated)
BgB	Bridget very fine sandy loam, 1 to 3 percent slopes (where irrigated)
BgC	Bridget very fine sandy loam, 3 to 6 percent slopes (where irrigated)
CrB	Creighton very fine sandy loam, 1 to 3 percent slopes (where irrigated)
CrC	Creighton very fine sandy loam, 3 to 6 percent slopes (where irrigated)
Dw	Duroc loam, 0 to 1 percent slopes (where irrigated)
DwB	Duroc loam, 1 to 3 percent slopes (where irrigated)
Gg	Glenberg very fine sandy loam, 0 to 2 percent slopes (where irrigated)
Go	Goshen loam, 0 to 1 percent slopes (where irrigated)
Ke	Keith loam, 0 to 1 percent slopes (where irrigated)
KeB	Keith loam, 1 to 3 percent slopes (where irrigated)
KeC	Keith loam, 3 to 6 percent slopes (where irrigated)
Mt	Mitchell very fine sandy loam, 0 to 1 percent slopes (where irrigated)
MtB	Mitchell very fine sandy loam, 1 to 3 percent slopes (where irrigated)
MtC	Mitchell very fine sandy loam, 3 to 6 percent slopes (where irrigated)
RbB	Rosebud loam, 1 to 3 percent slopes (where irrigated)
StB	Satanta fine sandy loam, 1 to 3 percent slopes (where irrigated)
SvC	Satanta-Altvan complex, 3 to 6 percent slopes (where irrigated)
Tr	Tripp very fine sandy loam, 0 to 1 percent slopes (where irrigated)
TrB	Tripp very fine sandy loam, 1 to 3 percent slopes (where irrigated)
TrC	Tripp very fine sandy loam, 3 to 6 percent slopes (where irrigated)
VnC	Vetal fine sandy loam, 3 to 6 percent slopes (where irrigated)
VtB	Vetal very fine sandy loam, 0 to 3 percent slopes (where irrigated)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Alfalfa hay		Dry beans		Corn		Winter wheat	
	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
AcB----------------- Alice	IIIe	IIe	1.6	5.4	---	36	---	135	35	---
AcC----------------- Alice	IVe	IIIe	1.4	4.2	---	30	---	120	30	---
AcD----------------- Alice	IVe	IVe	1.2	4.0	---	28	---	110	24	---
Ae------------------ Alliance	IIIc	I	---	5.8	---	40	---	145	40	---
AeB----------------- Alliance	IIIe	IIe	---	5.6	---	36	---	140	38	---
AeC----------------- Alliance	IIIe	IIIe	---	4.8	---	34	---	125	34	---
AeD2---------------- Alliance	IVe	IVe	---	4.0	---	28	---	100	26	---
AgC----------------- Altvan	IVe	IVe	---	3.9	---	28	---	112	24	---
AhD----------------- Altvan-Eckley	IVe	IVe	---	3.6	---	24	---	95	17	---
Bb------------------ Bankard	IVw	IVw	---	3.4	---	24	---	85	---	---
Bc------------------ Bankard	VIw	---	---	---	---	---	---	---	---	---
BdB----------------- Bayard	IIIe	IIe	---	5.5	---	37	---	135	38	---
BdC----------------- Bayard	IVe	IIIe	---	4.5	---	30	---	120	30	---
BdD----------------- Bayard	IVe	IVe	---	4.0	---	28	---	115	24	---
BdE----------------- Bayard	VIe	---	---	---	---	---	---	---	---	---
BeD----------------- Bayard-Dix	IVe	IVe	---	4.0	---	26	---	115	27	---
BeE----------------- Bayard-Dix	VIe	---	---	---	---	---	---	---	---	---
Bg------------------ Bridget	IIIc	IIe	---	5.8	---	39	---	145	40	---
BgB----------------- Bridget	IIIe	IIe	---	5.5	---	38	---	130	38	---

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Alfalfa hay		Dry beans		Corn		Winter wheat	
	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
BgC Bridget	IIIe	IIIe	---	5.2	---	32	---	120	34	---
BgD Bridget	IVe	IVe	---	4.3	---	28	---	90	27	---
BgE Bridget	VIe	---	---	---	---	---	---	---	---	---
BxE Busher-Tassel	VIe	---	---	---	---	---	---	---	---	---
CaF Canyon	VIs	---	---	---	---	---	---	---	---	---
CgG* Canyon-Rock outcrop	VIIs	---	---	---	---	---	---	---	---	---
CnE, CnE2 Canyon-Sidney	VIs	---	---	---	---	---	---	---	---	---
CrB Creighton	IIIe	IIe	---	5.6	---	36	---	130	36	---
CrC Creighton	IIIe	IIIe	---	4.8	---	34	---	120	34	---
DtB Dix	VIs	IVs	---	3.4	---	20	---	90	18	---
Dw Duroc	IIIc	I	---	6.0	---	40	---	150	42	---
DwB Duroc	IIIe	IIe	---	5.5	---	38	---	140	39	---
EcF Eckley	VIs	---	---	---	---	---	---	---	---	---
EkF Epping	VIs	---	---	---	---	---	---	---	---	---
Gg Glenberg	IIIw	IIw	---	5.4	---	34	---	132	36	---
Go Goshen	IIIc	I	---	6.0	---	40	---	142	40	---
Ja Janise	VIs	---	---	---	---	---	---	---	---	---
Ke Keith	IIIc	I	---	5.8	---	40	---	145	40	---
KeB Keith	IIIe	IIe	---	5.4	---	38	---	140	38	---
KeC Keith	IIIe	IIIe	---	4.8	---	34	---	130	36	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability N	Land capability I	Alfalfa hay N	Alfalfa hay I	Dry beans N	Dry beans I	Corn N	Corn I	Winter wheat N	Winter wheat I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
Lc------------------ Lisco	VIs	---	---	---	---	---	---	---	---	---
Lo------------------ Lodgepole	IIIw	IVw	---	3.8	---	25	---	90	20	---
Mt------------------ Mitchell	IIIc	IIe	---	5.4	---	36	---	135	38	---
MtB----------------- Mitchell	IIIe	IIe	---	5.2	---	34	---	130	36	---
MtC----------------- Mitchell	IIIe	IIIe	---	4.6	---	32	---	120	30	---
MtD----------------- Mitchell	IVe	IVe	---	3.7	---	26	---	110	24	---
MxD----------------- Mitchell-Epping	IVe	IVe	---	---	---	---	---	---	---	---
MxE----------------- Mitchell-Epping	VIe	---	---	---	---	---	---	---	---	---
OfB----------------- Otero	IVe	IIIe	---	4.2	---	26	---	115	28	---
OfD----------------- Otero	IVe	IVe	---	3.8	---	20	---	95	22	---
OfE----------------- Otero	VIe	---	---	---	---	---	---	---	---	---
OvG----------------- Otero-Epping	VIIe	---	---	---	---	---	---	---	---	---
RaG----------------- Rock outcrop-Epping	VIIs	---	---	---	---	---	---	---	---	---
RbB----------------- Rosebud	IIIe	IIIe	---	5.1	---	34	---	130	35	---
RcC----------------- Rosebud-Canyon	IVe	IVe	---	3.6	---	26	---	112	26	---
SaB----------------- Sarben	IVe	IIIe	---	3.7	---	26	---	110	25	---
SaD----------------- Sarben	IVe	IVe	---	3.5	---	20	---	100	22	---
StB----------------- Satanta	IIIe	IIe	---	5.4	---	38	---	140	38	---
SvC----------------- Satanta-Altvan	IIIe	IIIe	---	4.2	---	30	---	120	30	---
SxC----------------- Sidney-Canyon	IVe	IIIe	---	3.8	---	28	---	110	24	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Alfalfa hay		Dry beans		Corn		Winter wheat	
	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
SxD----------------- Sidney-Canyon	IVe	IVe	---	3.6	---	28	---	110	22	---
SxD2---------------- Sidney-Canyon	IVe	IVe	---	3.4	---	26	---	95	20	---
TcG*---------------- Tassel-Busher-Rock outcrop	VIIs	---	---	---	---	---	---	---	---	---
TfG*---------------- Tassel-Rock outcrop	VIIs	---	---	---	---	---	---	---	---	---
ToB----------------- Tripp	IVe	IIIe	---	4.2	---	26	---	115	28	---
ToC----------------- Tripp	IVe	IVe	---	4.0	---	24	---	100	25	---
Tr------------------ Tripp	IIIc	IIe	---	5.8	---	40	---	145	40	---
TrB----------------- Tripp	IIIe	IIe	---	5.6	---	38	---	140	38	---
TrC----------------- Tripp	IIIe	IIIe	---	4.8	---	34	---	130	34	---
TrD----------------- Tripp	IVe	IVe	---	4.0	---	28	---	115	26	---
VaD----------------- Valent	VIe	IVe	---	3.0	---	---	---	90	---	---
VaE----------------- Valent	VIe	---	---	---	---	---	---	---	---	---
VdB----------------- Valent	VIe	IVe	---	3.6	---	---	---	100	---	---
VdD----------------- Valent	VIe	IVe	---	3.3	---	---	---	95	---	---
VnC----------------- Vetal	IVe	IIIe	---	4.0	---	30	---	130	32	---
VtB----------------- Vetal	IIIe	IIe	---	4.7	---	38	---	135	35	---
Yp------------------ Yockey	IVs	IIIs	---	3.7	---	26	---	95	26	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I) Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	28,950	---	---	---	---
II (N)	---	---	---	---	---
(I)	104,720	103,120	1,600	---	---
III (N)	165,040	134,490	1,600	---	28,950
(I)	94,000	92,200	---	1,800	---
IV (N)	138,008	133,290	2,918	1,800	---
(I)	97,680	94,460	2,650	570	---
V (N)	---	---	---	---	---
VI (N)	111,760	65,590	5,200	40,970	---
VII (N)	63,400	2,850	---	60,550	---
VIII (N)	---	---	---	---	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
AcB, AcC, AcD------ Alice	Sandy------------------------	Favorable	2,300	Prairie sandreed--------------	20
		Normal	1,600	Needleandthread---------------	15
		Unfavorable	1,100	Blue grama--------------------	15
				Threadleaf sedge--------------	10
				Little bluestem---------------	10
				Sand dropseed-----------------	5
				Prairie junegrass-------------	5
				Western wheatgrass------------	5
				Sand bluestem-----------------	5
Ae, AeB, AeC------- Alliance	Silty------------------------	Favorable	2,500	Blue grama--------------------	20
		Normal	1,700	Western wheatgrass------------	20
		Unfavorable	1,000	Needleandthread---------------	20
				Buffalograss------------------	5
				Little bluestem---------------	5
				Sedge-------------------------	5
				Green needlegrass-------------	5
				Big bluestem------------------	5
AeD2-------------- Alliance	Silty------------------------	Favorable	2,300	Blue grama--------------------	20
		Normal	1,500	Western wheatgrass------------	20
		Unfavorable	1,000	Needleandthread---------------	20
				Buffalograss------------------	5
				Little bluestem---------------	5
				Sedge-------------------------	5
				Green needlegrass-------------	5
				Big bluestem------------------	5
AgC--------------- Altvan	Silty------------------------	Favorable	2,100	Western wheatgrass------------	25
		Normal	1,700	Blue grama--------------------	20
		Unfavorable	1,300	Needleandthread---------------	20
				Little bluestem---------------	10
				Buffalograss------------------	5
				Threadleaf sedge--------------	5
AhD*:					
Altvan------------	Silty------------------------	Favorable	2,100	Western wheatgrass------------	25
		Normal	1,700	Blue grama--------------------	20
		Unfavorable	1,300	Needleandthread---------------	20
				Little bluestem---------------	10
				Buffalograss------------------	5
				Threadleaf sedge--------------	5
Eckley------------	Shallow to Gravel------------	Favorable	1,400	Blue grama--------------------	25
		Normal	1,200	Western wheatgrass------------	20
		Unfavorable	800	Thickspike wheatgrass---------	20
				Needleandthread---------------	10
				Sedge-------------------------	10
				Prairie sandreed--------------	10
				Green needlegrass-------------	10
				Sideoats grama----------------	5
				Little bluestem---------------	5
Bb---------------- Bankard	Sandy Lowland----------------	Favorable	2,300	Prairie sandreed--------------	30
		Normal	2,100	Sand bluestem-----------------	20
		Unfavorable	1,800	Little bluestem---------------	20
				Needleandthread---------------	10
				Blue grama--------------------	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
BdB, BdC, BdD, BdE-Bayard	Sandy	Favorable	2,300	Prairie sandreed	30
		Normal	1,600	Blue grama	15
		Unfavorable	1,100	Needleandthread	15
				Sand bluestem	10
				Little bluestem	10
				Indian ricegrass	5
				Threadleaf sedge	5
BeD*, BeE*:					
Bayard	Sandy	Favorable	2,300	Prairie sandreed	30
		Normal	1,600	Blue grama	15
		Unfavorable	1,100	Needleandthread	15
				Sand bluestem	10
				Little bluestem	10
				Indian ricegrass	5
				Threadleaf sedge	5
Dix	Shallow to Gravel	Favorable	700	Blue grama	25
		Normal	600	Fendler threeawn	10
		Unfavorable	400	Needleandthread	10
				Sand dropseed	10
				Sand bluestem	5
				Little bluestem	5
				Buffalograss	5
				Prairie sandreed	5
Bg, BgB, BgC, BgD, BgE Bridget	Silty	Favorable	2,500	Needleandthread	20
		Normal	1,700	Blue grama	20
		Unfavorable	1,000	Western wheatgrass	20
				Threadleaf sedge	10
				Buffalograss	5
				Little bluestem	5
				Big bluestem	5
				Sideoats grama	5
BxE*:					
Busher	Sandy	Favorable	2,300	Prairie sandreed	30
		Normal	1,600	Needleandthread	15
		Unfavorable	1,200	Blue grama	15
				Sand bluestem	10
				Little bluestem	10
				Threadleaf sedge	5
				Indian ricegrass	5
Tassel	Shallow Limy	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Needleandthread	10
				Threadleaf sedge	10
				Sand bluestem	5
				Sideoats grama	5
				Bluegrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
CaF: Canyon	Shallow Limy	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Threadleaf sedge	10
				Needleandthread	10
				Sideoats grama	5
				Sand bluestem	5
				Bluegrass	5
CgG*:					
Canyon	Shallow Limy	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Threadleaf sedge	10
				Needleandthread	10
				Sideoats grama	5
				Sand bluestem	5
				Bluegrass	5
Rock outcrop.					
CnE*, CnE2*:					
Canyon	Shallow Limy	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Threadleaf sedge	10
				Needleandthread	10
				Sideoats grama	5
				Sand bluestem	5
				Bluegrass	5
Sidney	Silty	Favorable	2,200	Western wheatgrass	25
		Normal	1,500	Needleandthread	25
		Unfavorable	1,000	Blue grama	20
				Sedge	5
				Buffalograss	5
CrB, CrC: Creighton	Silty	Favorable	2,500	Blue grama	25
		Normal	1,700	Needleandthread	20
		Unfavorable	1,000	Western wheatgrass	20
				Threadleaf sedge	10
				Buffalograss	10
				Green needlegrass	5
DtB: Dix	Shallow to Gravel	Favorable	700	Blue grama	25
		Normal	600	Fendler threeawn	10
		Unfavorable	400	Needleandthread	10
				Sand bluestem	5
				Little bluestem	5
				Buffalograss	5
				Prairie sandreed	5
Dw: Duroc	Silty	Favorable	2,800	Western wheatgrass	25
		Normal	2,100	Blue grama	15
		Unfavorable	1,500	Needleandthread	15
				Threadleaf sedge	10
				Big bluestem	5
				Green needlegrass	5
				Little bluestem	5
				Prairie junegrass	5
				Buffalograss	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
DwB: Duroc	Silty	Favorable	2,500	Needleandthread	20
		Normal	1,700	Western wheatgrass	20
		Unfavorable	1,500	Blue grama	10
				Threadleaf sedge	10
				Big bluestem	5
				Green needlegrass	5
				Little bluestem	5
				Buffalograss	5
EcF: Eckley	Shallow to Gravel	Favorable	1,400	Blue grama	25
		Normal	1,200	Western wheatgrass	20
		Unfavorable	800	Thickspike wheatgrass	20
				Needleandthread	10
				Sedge	10
				Prairie sandreed	10
				Green needlegrass	10
				Sideoats grama	5
				Little bluestem	5
EkF: Epping	Shallow Limy	Favorable	1,000	Blue grama	20
		Normal	700	Needleandthread	15
		Unfavorable	500	Threadleaf sedge	10
				Sideoats grama	10
				Western wheatgrass	10
				Little bluestem	10
				Buffalograss	5
				Prairie sandreed	5
Gg: Glenberg	Sandy Lowland	Favorable	2,500	Prairie sandreed	30
		Normal	1,750	Sand bluestem	15
		Unfavorable	1,000	Blue grama	10
				Little bluestem	10
				Needleandthread	10
				Sand dropseed	5
				Sedge	5
				Western wheatgrass	5
Go: Goshen	Silty	Favorable	2,500	Blue grama	50
		Normal	2,000	Western wheatgrass	30
		Unfavorable	1,500	Buffalograss	10
Ja: Janise	Saline Subirrigated	Favorable	2,900	Alkali sacaton	35
		Normal	2,600	Inland saltgrass	15
		Unfavorable	2,300	Western wheatgrass	15
				Slender wheatgrass	10
				Plains bluegrass	10
				Sedge	5
Ke, KeB, KeC: Keith	Silty	Favorable	2,500	Blue grama	25
		Normal	1,700	Needleandthread	25
		Unfavorable	1,000	Western wheatgrass	20
				Sedge	10
				Buffalograss	5
				Little bluestem	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Lc: Lisco	Saline Subirrigated	Favorable	3,800	Alkali sacaton	40
		Normal	3,400	Western wheatgrass	20
		Unfavorable	3,000	Inland saltgrass	15
				Blue grama	5
				Sedge	5
				Plains bluegrass	5
Lo: Lodgepole	Clayey Overflow	Favorable	1,200	Western wheatgrass	40
		Normal	1,000	Blue grama	15
		Unfavorable	700	Buffalograss	15
				Green needlegrass	10
				Sedge	10
Mt, MtB, MtC, MtD: Mitchell	Limy Upland	Favorable	2,000	Blue grama	20
		Normal	1,300	Sideoats grama	15
		Unfavorable	700	Needleandthread	10
				Threadleaf sedge	10
				Little bluestem	10
				Western wheatgrass	10
				Buffalograss	5
				Prairie sandreed	5
MxD*, MxE*:					
Mitchell	Limy Upland	Favorable	2,000	Blue grama	20
		Normal	1,300	Sideoats grama	15
		Unfavorable	700	Needleandthread	10
				Threadleaf sedge	10
				Little bluestem	10
				Western wheatgrass	10
				Buffalograss	5
				Prairie sandreed	5
Epping	Shallow Limy	Favorable	1,000	Blue grama	20
		Normal	700	Needleandthread	15
		Unfavorable	500	Threadleaf sedge	10
				Sideoats grama	10
				Western wheatgrass	10
				Little bluestem	10
				Buffalograss	5
				Prairie sandreed	5
OfB, OfD, OfE: Otero	Sandy	Favorable	1,600	Blue grama	20
		Normal	1,300	Little bluestem	15
		Unfavorable	1,000	Prairie sandreed	10
				Threadleaf sedge	10
				Sand bluestem	10
				Sideoats grama	10
				Needleandthread	5
				Western wheatgrass	5
OvG*:					
Otero	Sandy	Favorable	1,600	Blue grama	20
		Normal	1,300	Little bluestem	15
		Unfavorable	1,000	Prairie sandreed	10
				Threadleaf sedge	10
				Sand bluestem	10
				Sideoats grama	10
				Needleandthread	5
				Western wheatgrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
OvG*:					
Epping	Shallow Limy	Favorable	1,000	Blue grama	20
		Normal	700	Needleandthread	15
		Unfavorable	500	Threadleaf sedge	10
				Sideoats grama	10
				Western wheatgrass	10
				Little bluestem	10
				Buffalograss	5
				Prairie sandreed	5
RaG*:					
Rock outcrop.					
Epping	Shallow Limy	Favorable	1,000	Blue grama	20
		Normal	700	Needleandthread	15
		Unfavorable	500	Threadleaf sedge	10
				Sideoats grama	10
				Western wheatgrass	10
				Little bluestem	10
				Buffalograss	5
				Prairie sandreed	5
RbB	Silty	Favorable	2,500	Blue grama	25
Rosebud		Normal	1,700	Needleandthread	20
		Unfavorable	1,000	Western wheatgrass	20
				Threadleaf sedge	10
				Green needlegrass	10
				Buffalograss	5
RcC*:					
Rosebud	Silty	Favorable	2,500	Blue grama	25
		Normal	1,700	Needleandthread	20
		Unfavorable	1,000	Western wheatgrass	20
				Threadleaf sedge	10
				Green needlegrass	10
				Buffalograss	5
Canyon	Shallow Limy	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Threadleaf sedge	10
				Needleandthread	10
				Sideoats grama	5
				Sand bluestem	5
				Bluegrass	5
SaB, SaD	Sandy	Favorable	2,300	Prairie sandreed	30
Sarben		Normal	1,900	Needleandthread	15
		Unfavorable	1,500	Blue grama	15
				Little bluestem	10
				Sedge	10
				Sand bluestem	5
				Sand sagebrush	5
				Western wheatgrass	5
StB	Silty	Favorable	3,200	Blue grama	20
Satanta		Normal	2,500	Western wheatgrass	20
		Unfavorable	1,800	Big bluestem	15
				Little bluestem	15
				Needleandthread	15
				Sideoats grama	10

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
SvC*:					
Satanta	Silty	Favorable	3,200	Blue grama	20
		Normal	2,500	Western wheatgrass	20
		Unfavorable	1,800	Big bluestem	15
				Little bluestem	15
				Needleandthread	15
				Sideoats grama	10
Altvan	Silty	Favorable	2,100	Western wheatgrass	25
		Normal	1,700	Blue grama	20
		Unfavorable	1,300	Needleandthread	20
				Little bluestem	10
				Buffalograss	5
				Threadleaf sedge	5
SxC*, SxD*, SxD2*:					
Sidney	Silty	Favorable	2,200	Western wheatgrass	25
		Normal	1,500	Needleandthread	25
		Unfavorable	1,000	Blue grama	20
				Sedge	5
				Buffalograss	5
Canyon	Shallow Limy	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Threadleaf sedge	10
				Needleandthread	10
				Sideoats grama	5
				Sand bluestem	5
				Bluegrass	5
TcG*:					
Tassel	Shallow Limy	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Needleandthread	10
				Threadleaf sedge	10
				Sand bluestem	5
				Sideoats grama	5
				Bluegrass	5
Busher	Savannah	Favorable	2,300	Prairie sandreed	30
		Normal	1,600	Needleandthread	15
		Unfavorable	1,200	Blue grama	15
				Sand bluestem	10
				Little bluestem	10
				Threadleaf sedge	5
				Indian ricegrass	5
Rock outcrop.					
TfG*:					
Tassel	Shallow Limy	Favorable	1,000	Blue grama	25
		Normal	700	Little bluestem	15
		Unfavorable	500	Western wheatgrass	15
				Needleandthread	10
				Threadleaf sedge	10
				Sand bluestem	5
				Sideoats grama	5
				Bluegrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
TfG*:					
Rock outcrop.					
ToB, ToC	Sandy	Favorable	2,300	Needleandthread	20
Tripp		Normal	1,900	Blue grama	20
		Unfavorable	1,500	Prairie sandreed	20
				Threadleaf sedge	10
				Western wheatgrass	10
				Little bluestem	5
				Sand bluestem	5
Tr, TrB, TrC, TrD	Silty	Favorable	2,500	Needleandthread	20
Tripp		Normal	1,700	Blue grama	20
		Unfavorable	1,000	Western wheatgrass	20
				Threadleaf sedge	10
				Little bluestem	5
				Buffalograss	5
				Green needlegrass	5
				Sideoats grama	5
VaD, VaE	Sands	Favorable	2,300	Prairie sandreed	25
Valent		Normal	1,900	Sand bluestem	15
		Unfavorable	1,500	Little bluestem	15
				Needleandthread	15
				Blue grama	10
				Sand dropseed	5
VdB	Sandy	Favorable	1,900	Prairie sandreed	25
Valent		Normal	1,600	Blue grama	15
		Unfavorable	1,300	Needleandthread	15
				Little bluestem	10
				Threadleaf sedge	10
				Sand bluestem	5
				Sand dropseed	5
VdD	Sands	Favorable	2,300	Prairie sandreed	25
Valent		Normal	1,900	Sand bluestem	15
		Unfavorable	1,500	Little bluestem	15
				Needleandthread	15
				Blue grama	10
				Sand dropseed	5
VnC, VtB	Sandy	Favorable	2,300	Prairie sandreed	30
Vetal		Normal	1,500	Little bluestem	15
		Unfavorable	1,200	Blue grama	15
				Needleandthread	10
				Sand bluestem	10
				Western wheatgrass	5
Yp	Saline Subirrigated	Favorable	3,300	Alkali sacaton	25
Yockey		Normal	2,900	Inland saltgrass	15
		Unfavorable	2,500	Switchgrass	10
				Slender wheatgrass	10
				Plains bluegrass	10
				Sedge	10
				Western wheatgrass	5
				Kentucky bluegrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
AcB, AcC, AcD----- Alice	American plum, Siberian peashrub, skunkbush sumac, lilac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm------	---
Ae, AeB, AeC------ Alliance	American plum, lilac, Siberian peashrub.	Rocky Mountain juniper, hackberry, Russian-olive.	Eastern redcedar, ponderosa pine, Austrian pine, Scotch pine, jack pine.	Siberian elm------	---
AeD2-------------- Alliance	American plum, lilac, skunkbush sumac.	Rocky Mountain juniper, Russian-olive.	Hackberry, eastern redcedar, ponderosa pine, Austrian pine, Scotch pine, jack pine.	Siberian elm------	---
AgC--------------- Altvan	Skunkbush sumac, lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
AhD*:					
Altvan-----------	Skunkbush sumac, lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Eckley.					
Bb---------------- Bankard	American plum, skunkbush sumac.	Siberian peashrub, Russian-olive, hackberry.	Eastern redcedar, honeylocust, green ash, ponderosa pine.	Siberian elm------	---
Bc. Bankard					
BdB, BdC, BdD----- Bayard	American plum, skunkbush sumac, lilac, Siberian peashrub.	Eastern redcedar, Russian mulberry, Rocky Mountain juniper.	Ponderosa pine, green ash, hackberry, honeylocust.	Siberian elm------	---
BdE--------------- Bayard	---	Eastern redcedar, Austrian pine, jack pine.	Ponderosa pine, Scotch pine.	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BeD*:					
Bayard	American plum, skunkbush sumac, lilac, Siberian peashrub.	Eastern redcedar, Russian mulberry, Rocky Mountain juniper.	Ponderosa pine, green ash, hackberry, honeylocust.	Siberian elm	---
Dix.					
BeE*:					
Bayard	---	Eastern redcedar, Austrian pine, jack pine.	Ponderosa pine, Scotch pine.	---	---
Dix.					
Bg, BgB, BgC, BgD, BgE Bridget	Skunkbush sumac, lilac, American plum.	Hackberry, Rocky Mountain juniper, Russian-olive, Siberian peashrub.	Ponderosa pine, green ash, eastern redcedar, honeylocust.	Siberian elm	---
BxE*:					
Busher	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
Tassel.					
CaF. Canyon					
CgG*:					
Canyon.					
Rock outcrop.					
CnE*, CnE2*:					
Canyon.					
Sidney	Skunkbush sumac, silver buffaloberry, lilac.	Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Eastern redcedar, ponderosa pine, Siberian elm, honeylocust, hackberry, green ash.	---	---
CrB, CrC Creighton	Lilac, American plum, skunkbush sumac.	Rocky Mountain juniper, Russian-olive, hackberry, Siberian peashrub.	Ponderosa pine, green ash, eastern redcedar, honeylocust.	Siberian elm	---
DtB. Dix					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Dw: Duroc	Amur honeysuckle, lilac, American plum.	---	Rocky Mountain juniper, ponderosa pine, honeylocust, green ash, Russian-olive, eastern redcedar, hackberry.	Siberian elm	Eastern cottonwood.
DwB: Duroc	Lilac, American plum.	Rocky Mountain juniper, Siberian peashrub, skunkbush sumac, hackberry.	Ponderosa pine, honeylocust, eastern redcedar, Scotch pine, green ash.	Siberian elm	---
EcF. Eckley					
EkF. Epping					
Gg: Glenberg	Lilac, American plum.	Amur honeysuckle	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, hackberry, green ash, Russian-olive.	Honeylocust, Siberian elm.	Eastern cottonwood.
Go: Goshen	Lilac, American plum.	Tatarian honeysuckle.	Eastern redcedar, blue spruce, ponderosa pine, green ash, hackberry, Russian-olive.	Honeylocust, Siberian elm.	Eastern cottonwood.
Ja. Janise					
Ke, KeB, KeC: Keith	Common chokecherry, American plum, lilac.	Hackberry, Manchurian crabapple, Russian-olive, green ash, Rocky Mountain juniper, Siberian peashrub.	Ponderosa pine, honeylocust.	Siberian elm	---
Lc. Lisco					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Lo---------------- Lodgepole	American plum, common chokecherry, lilac.	---	Eastern redcedar, ponderosa pine, honeylocust, hackberry, green ash, Russian mulberry.	Silver maple, golden willow.	Eastern redcedar.
Mt, MtB, MtC, MtD- Mitchell	Siberian peashrub, silver buffaloberry, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, Russian-olive, hackberry, honeylocust, green ash.	Siberian elm------	---	---
MxD*, MxE*:					
Mitchell---------	Siberian peashrub, silver buffaloberry, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, Russian-olive, hackberry, honeylocust, green ash.	Siberian elm------	---	---
Epping.					
OfB, OfD, OfE----- Otero	Siberian peashrub, silver buffaloberry, skunkbush sumac, Tatarian honeysuckle.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, green ash, Russian-olive, black locust.	Honeylocust, Siberian elm.	---	---
OvG*:					
Otero------------	Siberian peashrub, silver buffaloberry, skunkbush sumac, Tatarian honeysuckle.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, green ash, Russian-olive, black locust.	Honeylocust, Siberian elm.	---	---
Epping.					
RaG*:					
Rock outcrop.					
Epping.					
RbB--------------- Rosebud	Siberian peashrub, skunkbush sumac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, hackberry, Russian-olive, green ash.	Honeylocust, Siberian elm, ponderosa pine.	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
RcC*:					
Rosebud	Siberian peashrub, skunkbush sumac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, hackberry, Russian-olive, green ash.	Honeylocust, Siberian elm, ponderosa pine.	---	---
Canyon.					
SaB Sarben	Amur honeysuckle, American plum, common chokecherry, lilac.	Russian mulberry, Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, hackberry, green ash, honeylocust.	Siberian elm	---
SaD Sarben	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine	---	---
StB Satanta	Tatarian honeysuckle, American plum, Peking cotoneaster.	Eastern redcedar, common chokecherry, Rocky Mountain juniper.	Green ash, black locust, hackberry, Siberian elm, ponderosa pine, honeylocust.	---	---
SvC*:					
Satanta	Tatarian honeysuckle, American plum, Peking cotoneaster.	Eastern redcedar, common chokecherry, Rocky Mountain juniper.	Green ash, black locust, hackberry, Siberian elm, ponderosa pine, honeylocust.	---	---
Altvan	Skunkbush sumac, lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
SxC*, SxD*, SxD2*:					
Sidney	Skunkbush sumac, silver buffaloberry, lilac.	Russian-olive, Rocky Mountain juniper, Siberian peashrub.	Eastern redcedar, ponderosa pine, Siberian elm, honeylocust, hackberry, green ash.	---	---
Canyon.					
TcG*:					
Tassel.					
Busher.					
Rock outcrop.					
TfG*:					
Tassel.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
TfG*: Rock outcrop.					
ToB, ToC: Tripp	Lilac, American plum, Tatarian honeysuckle.	Rocky Mountain juniper, Russian-olive, Manchurian crabapple, Siberian peashrub, common chokecherry.	Ponderosa pine, green ash, honeylocust.	Siberian elm	---
Tr, TrB, TrC, TrD: Tripp	Lilac, skunkbush sumac, American plum.	Rocky Mountain juniper, Russian-olive, hackberry, Siberian peashrub.	Ponderosa pine, honeylocust, green ash, eastern redcedar.	Siberian elm	---
VaD, VaE, VdB, VdD: Valent	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
VnC, VtB: Vetal	American plum, skunkbush sumac, lilac, Siberian peashrub.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm	---
Yp: Yockey	Silver buffaloberry, Siberian peashrub, lilac.	Eastern redcedar, Rocky Mountain juniper, green ash, Russian-olive.	Golden willow, Siberian elm.	Eastern cottonwood	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
AcB: Alice	Slight	Slight	Slight	Slight.
AcC: Alice	Slight	Slight	Moderate: slope.	Slight.
AcD: Alice	Slight	Slight	Severe: slope.	Slight.
Ae: Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
AeB, AeC: Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
AeD2: Alliance	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
AgC: Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
AhD*:				
Altvan	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Eckley	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight.
Bb: Bankard	Severe: flooding.	Moderate: too sandy.	Moderate: too sandy, flooding.	Moderate: too sandy.
Bc: Bankard	Severe: flooding, too sandy.	Severe: too sandy.	Severe: flooding.	Severe: too sandy.
BdB: Bayard	Moderate: dusty.	Moderate: dusty.	Slight	Moderate: dusty.
BdC: Bayard	Moderate: dusty.	Moderate: dusty.	Moderate: slope.	Moderate: dusty.
BdD: Bayard	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
BdE: Bayard	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
BeD*:				
Bayard	Slight	Slight	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BeD*:				
Dix	Moderate: small stones, dusty.	Moderate: small stones, dusty.	Severe: slope, small stones.	Moderate: dusty.
BeE*:				
Bayard	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Dix	Moderate: slope, small stones, dusty.	Moderate: slope, small stones, dusty.	Severe: slope, small stones.	Moderate: dusty.
Bg Bridget	Severe: flooding.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
BgB Bridget	Severe: flooding.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
BgC Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
BgD Bridget	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
BgE Bridget	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
BxE*:				
Busher	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Tassel	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
CaF Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
CgG*:				
Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
CnE*, CnE2*:				
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Sidney	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
CrB, CrC: Creighton	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
DtB: Dix	Slight	Slight	Moderate: small stones.	Slight.
Dw: Duroc	Severe: flooding.	Slight	Slight	Slight.
DwB: Duroc	Slight	Slight	Moderate: slope.	Slight.
EcF: Eckley	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
EkF: Epping	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
Gg: Glenberg	Severe: flooding.	Moderate: dusty.	Moderate: flooding.	Moderate: dusty.
Go: Goshen	Severe: flooding.	Slight	Slight	Slight.
Ja: Janise	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Ke: Keith	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
KeB, KeC: Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Lc: Lisco	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: wetness.
Lo: Lodgepole	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
Mt: Mitchell	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.
MtB, MtC: Mitchell	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
MtD: Mitchell	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.
MxD*:				
Mitchell	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
MxD*:				
Epping	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
MxE*:				
Mitchell	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Epping	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: erodes easily.
OfB Otero	Slight	Slight	Slight	Slight.
OfD Otero	Slight	Slight	Severe: slope.	Slight.
OfE Otero	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
OvG*:				
Otero	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Epping	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
RaG*:				
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Epping	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, erodes easily.
RbB Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Moderate: dusty.
RcC*:				
Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock.	Moderate: dusty.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight.
SaB Sarben	Slight	Slight	Slight	Slight.
SaD Sarben	Slight	Slight	Severe: slope.	Slight.
StB Satanta	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SvC*:				
Satanta	Slight	Slight	Moderate: slope.	Slight.
Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
SxC*:				
Sidney	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight.
SxD*, SxD2*:				
Sidney	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
TcG*:				
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Busher	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
TfG*:				
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
ToB Tripp	Slight	Slight	Slight	Slight.
ToC Tripp	Slight	Slight	Moderate: slope.	Slight.
Tr Tripp	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
TrB, TrC Tripp	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
TrD Tripp	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
VaD, VaE: Valent	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VdB: Valent	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
VdD: Valent	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.
VnC, VtB: Vetal	Slight	Slight	Moderate: slope.	Slight.
Yp: Yockey	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
AcB, Alice	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
AcC, AcD, Alice	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Ae, AeB, AeC, Alliance	Good	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Poor	Good.
AeD2, Alliance	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AgC, Altvan	Fair	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AhD*:												
Altvan	Fair	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Eckley	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Bb, Bankard	Fair	Good	Good	Fair	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Fair.
Bc, Bankard	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
BdB, BdC, BdD, Bayard	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.	Fair.
BdE, Bayard	Poor	Fair	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
BeD*:												
Bayard	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.	Fair.
Dix	Poor	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
BeE*:												
Bayard	Poor	Fair	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Dix	Poor	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Bg, BgB, BgC, BgD, Bridget	Fair	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BgE, Bridget	Poor	Fair	Good	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
BxE*:												
Busher	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Tassel	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
CaF Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
CgG*:												
Canyon	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Rock outcrop	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	---	Very poor.	Very poor.	---	Very poor.
CnE*, CnE2*:												
Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Sidney	Poor	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
CrB, CrC Creighton	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Poor	Fair.
DtB Dix	Poor	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
Dw, DwB Duroc	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
EcF Eckley	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
EkF Epping	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
Gg Glenberg	Poor	Fair	Fair	Good	Good	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Go Goshen	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Ja Janise	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Poor	Very poor.	Poor	Very poor.
Ke, KeB Keith	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
KeC Keith	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Lc Lisco	Poor	Poor	Very poor.	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor.
Lo Lodgepole	Poor	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Mt, MtB, MtC, MtD-- Mitchell	Fair	Good	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Fair.
MxD*:												
Mitchell----------	Fair	Good	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Epping------------	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
MxE*:												
Mitchell----------	Poor	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Epping------------	Poor	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
OfB, OfD----------- Otero	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
OfE---------------- Otero	Poor	Fair	Good	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
OvG*:												
Otero-------------	Poor	Fair	Good	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Epping------------	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
RaG*:												
Rock outcrop------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	---	Very poor.	Very poor.	---	Very poor.
Epping------------	Very poor.	Very poor.	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
RbB---------------- Rosebud	Good	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
RcC*:												
Rosebud-----------	Fair	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Canyon------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
SaB, SaD----------- Sarben	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
StB---------------- Satanta	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
SvC*:												
Satanta-----------	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
Altvan------------	Fair	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
SxC*:												
Sidney	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
SxD*, SxD2*:												
Sidney	Fair	Good	Good	Fair	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Fair.
TcG*:												
Tassel	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.
Busher	Poor	Fair	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Rock outcrop	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	---	Very poor.	Very poor.	---	Very poor.
TfG*:												
Tassel	Very poor.	Very poor.	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Very poor.	Fair	Very poor.	Poor.
Rock outcrop	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	---	---	Very poor.	Very poor.	---	Very poor.
ToB, ToC Tripp	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Tr, TrB Tripp	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
TrC, TrD Tripp	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
VaD, VaE Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VdB Valent	Fair	Good	Fair	Poor	Fair	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VdD Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VnC, VtB Vetal	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Yp Yockey	Poor	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AcB: Alice	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
AcC, AcD: Alice	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Ae, AeB: Alliance	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
AeC, AeD2: Alliance	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
AgC: Altvan	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
AhD*:						
Altvan	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
Eckley	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: small stones, droughty.
Bb: Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Bc: Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty, flooding.
BdB: Bayard	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
BdC, BdD: Bayard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
BdE: Bayard	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
BeD*:						
Bayard	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Dix	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
BeE*:						
Bayard	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Dix	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Bg, BgB: Bridget	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding.	Slight.
BgC, BgD: Bridget	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.	Slight.
BgE: Bridget	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.	Moderate: slope.
BxE*:						
Busher	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Tassel	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: depth to rock.
CaF: Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
CgG*:						
Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
CnE*, CnE2*:						
Canyon	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: depth to rock.
Sidney	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: slope.
CrB: Creighton	Slight	Slight	Slight	Slight	Slight	Slight.
CrC: Creighton	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
DtB: Dix	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Dw: Duroc	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: shrink-swell, low strength, flooding.	Slight.
DwB: Duroc	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
EcF--------------- Eckley	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, droughty,
EkF--------------- Epping	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Gg---------------- Glenberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Go---------------- Goshen	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
Ja---------------- Janise	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Severe: excess sodium.
Ke, KeB----------- Keith	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
KeC--------------- Keith	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: low strength, frost action.	Slight.
Lc---------------- Lisco	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Severe: excess sodium.
Lo---------------- Lodgepole	Severe: cutbanks cave, ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
Mt, MtB----------- Mitchell	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
MtC, MtD---------- Mitchell	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
MxD*: Mitchell----------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
Epping-----------	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.
MxE*: Mitchell----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Epping-----------	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, shrink-swell, slope.	Severe: depth to rock.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OfB--------------- Otero	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
OfD--------------- Otero	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
OfE--------------- Otero	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
OvG*:						
Otero------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Epping-----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
RaG*:						
Rock outcrop-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Epping-----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
RbB--------------- Rosebud	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Moderate: frost action.	Moderate: depth to rock.
RcC*:						
Rosebud----------	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: depth to rock.
Canyon-----------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
SaB--------------- Sarben	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
SaD--------------- Sarben	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
StB--------------- Satanta	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
SvC*:						
Satanta----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
Altvan-----------	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.	Slight.
SxC*, SxD*, SxD2*:						
Sidney-----------	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SxC*, SxD*, SxD2*:						
Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: depth to rock.
TcG*:						
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Busher	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
TfG*:						
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
ToB Tripp	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
ToC Tripp	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Tr, TrB Tripp	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
TrC, TrD Tripp	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
VaD Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VaE Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
VdB Valent	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
VdD Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VnC Vetal	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
VtB Vetal	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Yp Yockey	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AcB, AcC------------ Alice	Slight-----------	Severe: seepage.	Moderate: too sandy.	Slight-----------	Good.
AcD----------------- Alice	Slight-----------	Severe: seepage, slope.	Moderate: too sandy.	Slight-----------	Good.
Ae------------------ Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Slight-----------	Fair: depth to rock.
AeB, AeC------------ Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Slight-----------	Fair: depth to rock.
AeD2---------------- Alliance	Moderate: depth to rock, percs slowly.	Severe: slope.	Severe: depth to rock.	Slight-----------	Fair: depth to rock.
AgC----------------- Altvan	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----------	Poor: seepage, too sandy.
AhD*:					
Altvan-------------	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----------	Poor: seepage, too sandy.
Eckley-------------	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----------	Poor: seepage, too sandy, small stones.
Bb, Bc-------------- Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
BdB, BdC------------ Bayard	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
BdD----------------- Bayard	Slight-----------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
BdE----------------- Bayard	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
BeD*:					
Bayard-------------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BeD*:					
Dix	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
BeE*:					
Bayard	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Dix	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Bg Bridget	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
BgB Bridget	Moderate: flooding, percs slowly.	Moderate: seepage, slope.	Moderate: flooding.	Moderate: flooding.	Good.
BgC Bridget	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
BgD Bridget	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
BgE Bridget	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
BxE*:					
Busher	Moderate: depth to rock, slope.	Severe: seepage, slope.	Severe: depth to rock.	Moderate: slope.	Fair: depth to rock, slope, thin layer.
Tassel	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
CaF Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
CgG*:					
Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Rock outcrop	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CnE*, CnE2*:					
Canyon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
Sidney	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: depth to rock, slope, thin layer.
CrB, CrC Creighton	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
DtB Dix	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Dw Duroc	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
DwB Duroc	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
EcF Eckley	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy, small stones.
EkF Epping	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Gg Glenberg	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding.	Severe: flooding.	Fair: too sandy.
Go Goshen	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Ja Janise	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: excess sodium.
Ke Keith	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
KeB, KeC Keith	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Lc Lisco	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: excess salt, excess sodium.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lo------------------ Lodgepole	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Mt------------------ Mitchell	Moderate: percs slowly.	Moderate: seepage.	Slight-----------	Slight-----------	Good.
MtB, MtC------------ Mitchell	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
MtD----------------- Mitchell	Moderate: percs slowly.	Severe: slope.	Slight-----------	Slight-----------	Good.
MxD*:					
Mitchell-----------	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
Epping-------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Poor: depth to rock.
MxE*:					
Mitchell-----------	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Epping-------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: depth to rock.
OfB----------------- Otero	Slight-----------	Severe: seepage.	Moderate: too sandy.	Slight-----------	Good.
OfD----------------- Otero	Slight-----------	Severe: seepage, slope.	Moderate: too sandy.	Slight-----------	Good.
OfE----------------- Otero	Moderate: slope.	Severe: seepage, slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: slope.
OvG*:					
Otero--------------	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
Epping-------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
RaG*:					
Rock outcrop-------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Epping-------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RbB------------------ Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Poor: depth to rock.
RcC*:					
Rosebud------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Poor: depth to rock.
Canyon-------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Poor: depth to rock.
SaB, SaD------------ Sarben	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
StB------------------ Satanta	Moderate: percs slowly.	Severe: seepage.	Moderate: too sandy.	Slight-----------	Fair: too sandy.
SvC*:					
Satanta------------	Moderate: percs slowly.	Severe: seepage.	Moderate: too sandy.	Slight-----------	Fair: too sandy.
Altvan-------------	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight-----------	Poor: seepage, too sandy.
SxC*:					
Sidney-------------	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: depth to rock, thin layer.
Canyon-------------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight-----------	Poor: depth to rock.
SxD*, SxD2*:					
Sidney-------------	Moderate: depth to rock, percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: depth to rock, thin layer.
Canyon-------------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight-----------	Poor: depth to rock.
TcG*:					
Tassel-------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.
Busher-------------	Severe: slope.	Severe: seepage, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Rock outcrop-------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
TfG*:					
Tassel-------------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: depth to rock, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
TfG*:					
Rock outcrop	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
ToB, ToC: Tripp	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Good.
Tr: Tripp	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
TrB, TrC: Tripp	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
TrD: Tripp	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
VaD: Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
VaE: Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy.
VdB, VdD: Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
VnC, VtB: Vetal	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Yp: Yockey	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, excess sodium.	Severe: flooding, wetness.	Poor: excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AcB, AcC, AcD Alice	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Ae, AeB, AeC, AeD2 Alliance	Fair: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
AgC Altvan	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
AhD*:				
Altvan	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
Eckley	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Bb Bankard	Good	Probable	Improbable: too sandy.	Poor: area reclaim, too sandy.
Bc Bankard	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, small stones, area reclaim.
BdB, BdC, BdD Bayard	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
BdE Bayard	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
BeD*:				
Bayard	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
Dix	Good	Probable	Probable	Poor: area reclaim, too sandy, small stones.
BeE*:				
Bayard	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BeE*:				
Dix	Good	Probable	Probable	Poor: area reclaim, too sandy, small stones.
Bg, BgB, BgC, BgD: Bridget	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BgE: Bridget	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
BxE*:				
Busher	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
Tassel	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
CaF: Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
CgG*:				
Canyon	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Rock outcrop	Poor: depth to rock, slope.	---	---	Poor: depth to rock, slope.
CnE*, CnE2*:				
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
Sidney	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
CrB, CrC: Creighton	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
DtB: Dix	Good	Probable	Probable	Poor: area reclaim, too sandy, small stones.
Dw, DwB: Duroc	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
EcF: Eckley	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EkF Epping	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Gg Glenberg	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, too clayey, small stones.
Go Goshen	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ja Janise	Fair: wetness.	Probable	Improbable: too sandy.	Poor: excess sodium.
Ke, KeB, KeC Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lc Lisco	Fair: wetness.	Probable	Improbable: too sandy.	Poor: excess salt, excess sodium.
Lo Lodgepole	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Mt, MtB, MtC, MtD Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
MxD*:				
Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Epping	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
MxE*:				
Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Epping	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
OfB, OfD Otero	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
OfE Otero	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, slope.
OvG*:				
Otero	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Epping	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RaG*:				
Rock outcrop	Poor: depth to rock, slope.	---	---	Poor: depth to rock, slope.
Epping	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
RbB Rosebud	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
RcC*:				
Rosebud	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones.
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
SaB, SaD Sarben	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
StB Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
SvC*:				
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Altvan	Good	Probable	Probable	Fair: small stones, area reclaim, thin layer.
SxC*, SxD*, SxD2*:				
Sidney	Fair: depth to rock, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Canyon	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock.
TcG*:				
Tassel	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Busher	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop	Poor: depth to rock, slope.	---	---	Poor: depth to rock, slope.
TfG*:				
Tassel	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TfG*:				
Rock outcrop	Poor: depth to rock, slope.	---	---	Poor: depth to rock, slope.
ToB, ToC, Tr, TrB, TrC, TrD Tripp	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
VaD, VaE, VdB, VdD Valent	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VnC, VtB Vetal	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Yp Yockey	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AcB--------------- Alice	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Soil blowing---	Too arid, droughty.
AcC, AcD---------- Alice	Severe: seepage.	Severe: piping.	Deep to water	Slope, droughty, soil blowing.	Soil blowing---	Too arid, droughty.
Ae, AeB----------- Alliance	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Too arid, erodes easily.
AeC--------------- Alliance	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
AeD2-------------- Alliance	Moderate: seepage, depth to rock, slope.	Slight---------	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
AgC--------------- Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Slope----------	Too sandy------	Too arid.
AhD*:						
Altvan-----------	Severe: seepage.	Severe: seepage.	Deep to water	Slope----------	Too sandy------	Too arid.
Eckley-----------	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy------	Too arid, droughty.
Bb---------------- Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Too arid, droughty, rooting depth.
Bc---------------- Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty, rooting depth.
BdB--------------- Bayard	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
BdC, BdD---------- Bayard	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
BdE--------------- Bayard	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
BeD*:						
Bayard-----------	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
Dix--------------	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy------	Too arid, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
BeE*:						
Bayard	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Too arid, slope.
Dix	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Too arid, slope, droughty.
Bg, BgB Bridget	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Erodes easily, soil blowing.	Too arid, erodes easily.
BgC, BgD Bridget	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
BgE Bridget	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.
BxE*:						
Busher	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Slope, soil blowing.	Too arid, slope.
Tassel	Severe: depth to rock, slope.	Slight	Deep to water	Slope, fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope, depth to rock.
CaF Canyon	Severe: depth to rock, slope.	Slight	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Too arid, slope.
CgG*:						
Canyon	Severe: depth to rock, slope.	Slight	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Too arid, slope.
Rock outcrop	Severe: depth to rock, slope.	---	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
CnE*, CnE2*:						
Canyon	Severe: depth to rock, slope.	Slight	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Too arid, slope.
Sidney	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Too arid, slope.
CrB Creighton	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Erodes easily, soil blowing.	Too arid, erodes easily.
CrC Creighton	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
DtB Dix	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Too arid, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Dw, DwB----------- Duroc	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
EcF--------------- Eckley	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Too arid, slope, droughty.
EkF--------------- Epping	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
Gg---------------- Glenberg	Severe: seepage.	Severe: piping.	Deep to water	Droughty, rooting depth.	Too sandy------	Too arid, droughty, rooting depth.
Go---------------- Goshen	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Ja---------------- Janise	Severe: seepage.	Severe: piping, excess sodium.	Flooding, frost action, cutbanks cave.	Wetness, flooding, excess sodium.	Erodes easily, wetness.	Excess sodium, erodes easily.
Ke, KeB----------- Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Too arid, erodes easily.
KeC--------------- Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Too arid, erodes easily.
Lc---------------- Lisco	Severe: seepage.	Severe: piping, wetness, excess sodium.	Cutbanks cave, excess salt.	Wetness--------	Erodes easily, wetness, soil blowing.	Excess sodium, erodes easily.
Lo---------------- Lodgepole	Severe: seepage.	Severe: thin layer, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
Mt, MtB----------- Mitchell	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Too arid, erodes easily.
MtC, MtD---------- Mitchell	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
MxD*:						
Mitchell---------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
Epping-----------	Severe: depth to rock.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock, erodes easily.	Too arid, erodes easily.
MxE*:						
Mitchell---------	Severe: slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Slope, erodes easily, soil blowing.	Too arid, slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
MxE*:						
Epping	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
OfB: Otero	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Too arid.
OfD: Otero	Severe: seepage.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing	Too arid.
OfE: Otero	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Slope, soil blowing.	Too arid, slope.
OvG*:						
Otero	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Slope, soil blowing.	Too arid, slope.
Epping	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
RaG*:						
Rock outcrop	Severe: depth to rock, slope.	---	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
Epping	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Slope, depth to rock, erodes easily.	Too arid, slope, erodes easily.
RbB: Rosebud	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Too arid, depth to rock.
RcC*:						
Rosebud	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, depth to rock.	Depth to rock	Too arid, depth to rock.
Canyon	Severe: depth to rock.	Slight	Deep to water	Slope, depth to rock.	Depth to rock	Too arid.
SaB: Sarben	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
SaD: Sarben	Severe: seepage.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Soil blowing	Favorable.
StB: Satanta	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Soil blowing	Too arid.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
SvC*:						
Satanta	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, soil blowing.	Soil blowing	Too arid.
Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Too arid.
SxC*, SxD*, SxD2*:						
Sidney	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope	Favorable	Too arid.
Canyon	Severe: depth to rock.	Slight	Deep to water	Slope, depth to rock.	Depth to rock	Too arid.
TcG*:						
Tassel	Severe: depth to rock, slope.	Slight	Deep to water	Slope, fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope, depth to rock.
Busher	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Slope, soil blowing.	Too arid, slope.
Rock outcrop	Severe: depth to rock, slope.	---	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
TfG*:						
Tassel	Severe: depth to rock, slope.	Slight	Deep to water	Slope, fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Too arid, slope, depth to rock.
Rock outcrop	Severe: depth to rock, slope.	---	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
ToB Tripp	Moderate: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
ToC Tripp	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, fast intake, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
Tr, TrB Tripp	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Erodes easily, soil blowing.	Too arid, erodes easily.
TrC, TrD Tripp	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, soil blowing.	Erodes easily, soil blowing.	Too arid, erodes easily.
VaD Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
VaE Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Too arid, slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
VdB: Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
VdD: Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Too arid, droughty.
VnC: Vetal	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing	Favorable.
VtB: Vetal	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
Yp: Yockey	Moderate: seepage.	Severe: piping, excess sodium.	Flooding, excess salt, excess sodium.	Wetness, flooding.	Erodes easily, wetness.	Excess salt, excess sodium, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
AcB, AcC, AcD---- Alice	0-10	Fine sandy loam	SM, ML, SC-SM	A-4	0	100	95-100	95-100	45-60	20-30	NP-10
	10-30	Fine sandy loam, loamy very fine sand.	SM, ML, SC-SM, CL-ML	A-4	0	100	95-100	95-100	45-60	15-30	NP-10
	30-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	SM, ML, SC-SM, CL-ML	A-4	0	100	95-100	95-100	45-60	15-30	NP-10
Ae, AeB, AeC----- Alliance	0-8	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-75	20-40	2-15
	8-24	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	70-100	30-50	15-25
	24-44	Very fine sandy loam, silt loam, loam.	ML, CL-ML, SM	A-4	5-10	85-100	85-100	70-100	40-90	<30	NP-10
	44-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
AeD2------------- Alliance	0-4	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-75	20-40	1-15
	4-20	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0	100	100	90-100	70-95	30-50	15-25
	20-42	Very fine sandy loam, silt loam, loam.	SM, ML	A-4	5-10	85-100	85-100	70-100	40-90	<30	NP-5
	42-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
AgC-------------- Altvan	0-8	Loam-------------	ML, CL-ML	A-4	0	100	100	85-95	60-75	20-30	2-10
	8-25	Clay loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-100	60-80	25-40	5-15
	25-29	Loam, silt loam	ML, CL-ML	A-4	0	85-100	80-100	70-95	55-75	25-35	2-10
	29-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP-SM	A-1	0	60-95	55-90	25-60	5-10	---	NP
AhD*:											
Altvan----------	0-7	Loam-------------	ML, CL-ML	A-4	0	100	100	85-95	60-75	20-30	2-10
	7-21	Clay loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-100	60-80	25-40	5-15
	21-30	Loam, silt loam	ML, CL-ML	A-4	0	85-100	80-100	70-95	55-75	25-35	2-10
	30-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP-SM	A-1	0	60-95	55-90	25-60	5-10	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
AhD*:											
Eckley----------	0-7	Gravelly sandy loam.	SM, GM, GM-GC, SC-SM	A-2, A-1, A-4	0	60-80	50-75	35-65	20-50	20-30	NP-10
	7-11	Gravelly sandy clay loam, sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	65-95	50-90	30-75	20-65	30-40	10-20
	11-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP
Bb-------------- Bankard	0-8	Loamy fine sand	SM	A-2	0	95-100	90-100	50-90	15-35	---	NP
	8-60	Stratified loamy fine sand to sand.	SM, SP-SM	A-2	0	95-100	75-100	60-80	10-25	---	NP
Bc-------------- Bankard	0-5	Fine sand--------	SP, SP-SM	A-2, A-3	0	90-100	85-100	50-70	0-15	---	NP
	5-60	Fine sand, sand, loamy sand.	SP-SM, SM	A-2, A-3, A-1	0-5	80-100	75-100	40-70	5-35	---	NP
BdB, BdC, BdD, BdE------------ Bayard	0-18	Very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	90-100	90-100	75-95	30-65	20-40	3-10
	18-60	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	90-100	80-100	55-95	30-65	20-40	3-10
BeD*, BeE*:											
Bayard----------	0-12	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2, A-4	0	90-100	80-100	45-85	25-55	20-40	3-10
	12-60	Fine sandy loam, loamy very fine sand, very fine sandy loam.	ML, SM, SC-SM, CL-ML	A-2, A-4	0	90-100	80-100	55-95	30-65	20-40	3-10
Dix------------	0-15	Gravelly loam----	SM, GM	A-4, A-2	0	50-80	50-75	40-70	30-50	<35	NP-10
	15-60	Very gravelly coarse sand, very gravelly sand, gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-5	30-60	25-50	10-35	0-10	---	NP
Bg, BgB, BgC, BgD, BgE-------- Bridget	0-13	Very fine sandy loam.	ML, CL-ML, CL, SM	A-4	0	95-100	95-100	75-100	45-90	20-35	3-10
	13-18	Very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	3-10
	18-60	Very fine sandy loam, silt loam, loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	3-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BxE*:											
Busher	0-7	Loamy very fine sand.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	7-48	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	<25	NP-5
	48-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tassel	0-4	Loamy very fine sand.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	75-95	30-65	<25	NP-8
	4-12	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC	A-4, A-2	0	95-100	80-100	60-95	25-60	<25	NP-8
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CaF Canyon	0-10	Loam	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	10-16	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CgG*:											
Canyon	0-7	Loam	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	7-15	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop	0-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CnE*:											
Canyon	0-6	Loam	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	6-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Sidney	0-14	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	20-36	2-15
	14-41	Loam, very fine sandy loam, fine sandy loam.	CL-ML, CL, SC-SM, SC	A-4, A-6	0	95-100	85-100	65-100	35-85	20-40	5-15
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CnE2*:											
Canyon	0-6	Loam	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	6-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
CnE2*:											
Sidney----------	0-5	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	20-36	2-15
	5-41	Loam, very fine sandy loam, fine sandy loam.	CL-ML, CL, SC-SM, SC	A-4, A-6	0	95-100	85-100	65-100	35-85	20-40	5-15
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CrB, CrC--------- Creighton	0-11	Very fine sandy loam.	ML, CL-ML	A-4	0	100	90-100	85-100	50-65	<25	NP-5
	11-25	Very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	90-100	85-100	60-80	<30	NP-10
	25-60	Very fine sandy loam, loam.	ML, CL-ML, CL	A-4	0	100	90-100	85-100	60-80	<30	NP-10
DtB------------- Dix	0-18	Sandy loam-------	SM, ML, SC, SC-SM	A-2, A-4, A-1	0	95-100	75-100	40-80	20-55	<30	NP-10
	18-60	Very gravelly coarse sand, very gravelly sand, coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-5	30-60	25-50	10-35	0-10	---	NP
Dw-------------- Duroc	0-7	Loam-------------	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	60-100	25-35	5-15
	7-21	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
	21-60	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
DwB------------- Duroc	0-7	Loam-------------	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	60-100	25-35	5-15
	7-34	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
	34-60	Loam, silt loam	CL, CL-ML	A-6, A-4	0	100	95-100	85-100	70-100	25-35	5-15
EcF------------- Eckley	0-7	Gravelly sandy loam.	SM, GM, GM-GC, SC-SM	A-2, A-1, A-4	0	60-80	50-75	35-65	20-50	20-30	NP-10
	7-14	Gravelly sandy clay loam, sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	65-95	50-90	30-75	20-65	30-40	10-20
	14-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP
EkF------------- Epping	0-5	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	85-100	65-100	15-30	2-10
	5-15	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Gg-------------- Glenberg	0-6	Very fine sandy loam.	ML, CL-ML	A-4	0	95-100	95-100	85-100	50-70	15-25	NP-10
	6-60	Stratified loamy sand to clay loam.	SM	A-2, A-4	0	90-100	75-100	50-100	25-40	15-20	NP-5

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Go----------------Goshen	0-12	Loam-------------	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	70-95	20-40	3-20
	12-32	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	100	90-100	85-95	25-40	8-22
	32-60	Silt loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	20-35	4-15
Ja----------------Janise	0-2	Loam-------------	ML, CL-ML	A-4	0	100	100	85-95	60-75	20-30	3-10
	2-18	Loam-------------	ML, CL-ML	A-4	0	100	100	85-95	60-75	20-30	3-10
	18-42	Loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	100	85-95	50-75	20-35	3-10
	42-60	Loamy very fine sand.	ML, CL-ML, SC-SM	A-4	0	100	100	90-95	40-60	20-25	3-10
Ke, KeB, KeC-----Keith	0-9	Loam-------------	CL, ML, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	9-29	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	29-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	2-12
Lc----------------Lisco	0-6	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	100	60-85	30-55	<20	NP-5
	6-36	Very fine sandy loam, fine sandy loam, loamy very fine sand.	SM, SC-SM, ML, CL-ML	A-4, A-2	0	100	95-100	60-95	30-65	<25	NP-5
	36-60	Fine sandy loam, loamy fine sand, sand.	SM, SP-SM, ML, SC-SM	A-4, A-2, A-3	0	100	95-100	51-85	5-55	<20	NP-5
Lo----------------Lodgepole	0-5	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	95-100	90-100	90-100	70-95	20-40	3-20
	5-31	Silty clay loam, silty clay, clay.	CH	A-7	0	95-100	90-100	90-100	85-95	50-65	25-40
	31-49	Silt loam, very fine sandy loam, loam.	CL, CL-ML, ML	A-4	0	95-100	90-100	90-100	60-90	20-35	3-10
	49-60	Sandy loam, fine sandy loam, loamy sand.	SM, ML	A-4	0	95-100	90-100	70-90	15-60	---	NP
Mt, MtB, MtC, MtD-------------Mitchell	0-7	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	65-95	20-35	2-10
	7-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	100	95-100	85-100	60-100	20-35	NP-10
MxD*, MxE*: Mitchell---------	0-6	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	85-100	65-95	20-35	2-10
	6-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	100	95-100	85-100	60-100	20-35	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
MxD*, MxE*:											
Epping	0-4	Silt loam	ML, CL, CL-ML	A-4	0	100	95-100	85-100	65-100	15-30	2-10
	4-14	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
OfB, OfD, OfE Otero	0-12	Loamy very fine sand.	SM, ML	A-4, A-2	0	100	95-100	90-95	40-60	---	NP
	12-60	Very fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	100	95-100	85-95	40-60	---	NP-5
OvG*:											
Otero	0-15	Loamy very fine sand.	SM, ML	A-4, A-2	0	100	95-100	90-95	40-60	---	NP
	15-60	Very fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	100	95-100	85-95	40-60	---	NP-5
Epping	0-4	Silt loam	ML, CL, CL-ML	A-4	0	100	95-100	85-100	65-100	15-30	2-10
	4-16	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RaG*:											
Rock outcrop	0-12	Weathered bedrock	---	---	---	---	---	---	---	---	---
Epping	0-4	Silt loam	ML, CL, CL-ML	A-4	0	100	95-100	85-100	65-100	15-30	2-10
	4-16	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	75-100	60-95	15-35	2-15
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RbB Rosebud	0-7	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	24-34	3-12
	7-20	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	60-85	30-50	12-26
	20-38	Sandy loam, very fine sandy loam, loam.	SM, ML, CL-ML, SC-SM	A-4, A-6, A-2	0	95-100	80-100	60-100	30-90	20-40	2-12
	38-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RcC*:											
Rosebud	0-7	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	24-34	3-12
	7-25	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	60-85	30-50	12-26
	25-31	Sandy loam, very fine sandy loam, loam.	SM, ML, CL-ML, SC-SM	A-4, A-6, A-2	0	95-100	80-100	60-100	30-90	20-40	2-12
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon	0-6	Loam	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	6-18	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
SaB, SaD: Sarben	0-7	Loamy very fine sand.	SM, ML	A-2, A-4	0	100	100	90-100	30-60	<30	NP
	7-29	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<30	NP
	29-60	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<30	NP
StB: Satanta	0-5	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	95-100	70-85	40-55	<25	NP-5
	5-25	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	45-75	30-45	10-20
	25-47	Fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	95-100	70-95	40-60	20-30	NP-5
	47-60	Loamy fine sand	SM	A-2-4, A-1-b	0	100	90-100	45-75	15-30	<25	NP
SvC*:											
Satanta	0-7	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4	0	100	95-100	70-85	40-55	<25	NP-5
	7-24	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	45-75	30-45	10-20
	24-60	Fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	95-100	70-95	40-60	20-30	NP-5
Altvan	0-7	Loam	ML, CL-ML	A-4	0	100	100	85-95	60-75	20-30	2-10
	7-22	Clay loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-100	60-80	25-40	5-15
	22-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP-SM	A-1	0	60-95	55-90	25-60	5-10	---	NP
SxC*, SxD*:											
Sidney	0-15	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	20-36	2-15
	15-48	Loam, very fine sandy loam, fine sandy loam.	CL-ML, CL, SC-SM, ML	A-4, A-6	0	95-100	85-100	65-100	35-85	20-40	2-15
	48-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon	0-6	Loam	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	6-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments >3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
SxD2*:											
Sidney----------	0-7	Loam------------	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	20-36	2-15
	7-48	Loam, very fine sandy loam, fine sandy loam.	CL-ML, CL, SC-SM, ML	A-4, A-6	0	95-100	85-100	65-100	35-85	20-40	2-15
	48-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SxD2*:											
Canyon----------	0-4	Loam------------	ML, CL, CL-ML, SM	A-4	0-5	90-95	75-95	50-95	40-75	15-30	2-10
	4-13	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4, A-6, A-2	0-5	60-95	50-95	40-95	30-75	20-40	NP-15
	13-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
TcG*:											
Tassel----------	0-9	Loamy very fine sand.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	75-95	30-65	<25	NP-8
	9-16	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC	A-4, A-2	0	95-100	80-100	60-95	25-60	<25	NP-8
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Busher----------	0-9	Loamy very fine sand.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	80-100	30-60	<25	NP-5
	9-48	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML, SC-SM, CL-ML	A-2, A-4	0	100	90-100	75-100	30-65	<25	NP-5
	48-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
TfG*:											
Tassel----------	0-7	Loamy very fine sand.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	95-100	90-100	75-95	30-65	<25	NP-8
	7-15	Fine sandy loam, sandy loam, loamy very fine sand.	ML, CL-ML, SM, SC	A-4, A-2	0	95-100	80-100	60-95	25-60	<25	NP-8
	15-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ToB, ToC--------- Tripp	0-16	Loamy very fine sand.	SM, SC-SM, ML	A-2, A-4	0	95-100	95-100	90-95	40-60	<25	NP-8
	16-30	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	80-95	20-35	2-12
	30-60	Loam, very fine sandy loam.	ML	A-4	0	95-100	95-100	85-95	60-75	25-35	2-8

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments >3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Tr, TrB, TrC, TrD-------------- Tripp	0-12	Very fine sandy loam.	SC, SC-SM, CL-ML, ML	A-4, A-6	0	95-100	95-100	70-100	40-90	20-35	4-20
	12-21	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	80-95	20-35	2-12
	21-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-90	20-35	2-12
VaD, VaE--------- Valent	0-5	Fine sand--------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
	5-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VdB, VdD--------- Valent	0-7	Loamy fine sand	SM, SP-SM	A-2	0	100	100	70-95	10-30	<25	NP-5
	7-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2	0	100	95-100	75-90	10-30	---	NP
VnC-------------- Vetal	0-14	Fine sandy loam	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	100	60-100	30-55	20-30	NP-10
	14-36	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-10
	36-60	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-10
VtB-------------- Vetal	0-30	Very fine sandy loam.	CL, ML, SM, SC	A-4, A-6, A-2	0	100	100	90-100	30-55	20-35	NP-12
	30-40	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-10
	40-60	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SC-SM	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-10
Yp--------------- Yockey	0-6	Loam-------------	ML, CL-ML, CL	A-4	0	100	100	85-100	60-90	<25	NP-10
	6-60	Very fine sandy loam, loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	50-90	<25	NP-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
AcB, AcC, AcD: Alice	0-10	7-10	1.30-1.50	2.0-6.0	0.10-0.18	6.6-7.8	<2	Low	0.20	5	3	1-3
	10-30	5-18	1.30-1.50	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low	0.24			
	30-60	5-18	1.40-1.60	2.0-6.0	0.08-0.19	7.4-8.4	<2	Low	0.24			
Ae, AeB, AeC: Alliance	0-8	15-20	1.25-1.45	0.6-2.0	0.20-0.22	6.6-7.8	<2	Low	0.28	5	5	2-4
	8-24	25-35	1.15-1.30	0.2-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	24-44	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low	0.24			
	44-60	---	---	0.2-0.6	---	---	---	---	---			
AeD2: Alliance	0-4	18-27	1.35-1.55	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low	0.32	4	6	.5-2
	4-20	22-35	1.15-1.30	0.2-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	20-42	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low	0.24			
	42-60	---	---	0.2-0.6	---	---	---	---	---			
AgC: Altvan	0-8	16-23	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low	0.28	4	5	1-2
	8-25	20-35	1.30-1.50	0.6-2.0	0.17-0.19	6.6-8.4	<2	Moderate	0.32			
	25-29	18-25	1.25-1.50	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low	0.32			
	29-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-8.4	<2	Low	0.10			
AhD*:												
Altvan	0-7	16-23	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low	0.28	4	5	1-2
	7-21	20-35	1.30-1.50	0.6-2.0	0.17-0.19	6.6-8.4	<2	Moderate	0.32			
	21-30	18-25	1.25-1.50	0.6-2.0	0.15-0.19	7.4-8.4	<2	Low	0.32			
	30-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-8.4	<2	Low	0.10			
Eckley	0-7	10-20	1.30-1.35	2.0-6.0	0.09-0.12	6.6-7.3	<2	Low	0.15	2	5	2-4
	7-11	20-35	1.40-1.50	0.6-2.0	0.13-0.16	6.6-7.3	<2	Moderate	0.15			
	11-60	0-5	1.55-1.65	>6.0	0.03-0.06	6.6-7.8	<2	Low	0.10			
Bb: Bankard	0-8	2-10	1.80-1.95	6.0-20	0.10-0.15	7.4-8.4	<2	Low	0.17	5	2	.5-1
	8-60	0-10	1.85-2.00	6.0-20	0.07-0.15	7.4-9.0	<2	Low	0.17			
Bc: Bankard	0-5	0-5	1.65-1.75	>20	0.04-0.06	7.4-8.4	<2	Low	0.10	5	1	.5-2
	5-60	2-10	1.65-1.75	6.0-20	0.05-0.08	7.4-8.4	<2	Low	0.10			
BdB, BdC, BdD, BdE: Bayard	0-18	5-18	1.20-1.50	2.0-6.0	0.17-0.18	6.6-7.8	<2	Low	0.32	5	3	1-3
	18-60	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low	0.20			
BeD*, BeE*:												
Bayard	0-12	5-18	1.30-1.50	2.0-6.0	0.13-0.18	6.6-7.8	<2	Low	0.20	5	3	1-3
	12-60	5-18	1.20-1.50	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low	0.20			
Dix	0-15	5-20	1.60-1.80	0.6-2.0	0.12-0.18	6.1-7.8	<2	Low	0.17	2	7	1-2
	15-60	0-3	1.70-2.00	>20	0.02-0.04	6.6-8.4	<2	Low	0.05			
Bg, BgB, BgC, BgD, BgE: Bridget	0-13	5-18	1.30-1.50	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low	0.32	5	3	1-3
	13-18	5-18	1.40-1.60	0.6-2.0	0.16-0.24	7.4-8.4	<2	Low	0.43			
	18-60	5-18	1.40-1.60	0.6-2.0	0.16-0.24	7.4-8.4	<2	Low	0.43			
BxE*:												
Busher	0-7	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low	0.20	5	2	1-2
	7-48	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low	0.28			
	48-60	---	---	0.2-0.6	---	---	---	---	---			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
BxE*:												
Tassel----------	0-4	2-10	1.60-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-------	0.24	2	2	.5-3
	4-12	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low-------	0.24			
	12-60	---	---	0.2-0.6	---	---	---	----------	----			
CaF-------------- Canyon	0-10	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.32	2	4L	.5-2
	10-16	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.20			
	16-60	---	---	0.2-0.6	---	---	---	----------	----			
CgG*:												
Canyon----------	0-7	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.32	2	4L	.5-2
	7-15	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.20			
	15-60	---	---	0.2-0.6	---	---	---	----------	----			
Rock outcrop----	0-60	---	---	0.2-0.6	---	---	---	----------	----	---	---	---
CnE*:												
Canyon----------	0-6	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.32	2	4L	.5-2
	6-14	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.20			
	14-60	---	---	0.2-0.6	---	---	---	----------	----			
Sidney----------	0-14	10-20	1.20-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.28	5	4L	1-3
	14-41	5-20	1.15-1.30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28			
	41-60	---	---	0.2-0.6	---	---	---	----------	----			
CnE2*:												
Canyon----------	0-6	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.32	2	4L	.5-2
	6-14	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.20			
	14-60	---	---	0.2-0.6	---	---	---	----------	----			
Sidney----------	0-5	10-20	1.20-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.28	5	4L	1-3
	5-41	5-20	1.15-1.30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28			
	41-60	---	---	0.2-0.6	---	---	---	----------	----			
CrB, CrC--------- Creighton	0-11	5-15	1.25-1.35	0.6-2.0	0.15-0.17	6.1-7.8	<2	Low-------	0.32	5	3	1-3
	11-25	5-18	1.30-1.40	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low-------	0.43			
	25-60	5-18	1.30-1.40	0.6-2.0	0.15-0.17	7.9-9.0	0-2	Low-------	0.43			
DtB-------------- Dix	0-18	7-18	1.30-1.50	2.0-6.0	0.13-0.18	6.1-7.8	<2	Low-------	0.20	2	3	1-2
	18-60	0-3	1.70-2.00	>20	0.02-0.04	6.6-8.4	<2	Low-------	0.05			
Dw--------------- Duroc	0-7	15-20	1.20-1.45	0.6-2.0	0.12-0.22	6.6-7.8	<2	Moderate	0.28	5	5	1-3
	7-21	18-27	1.40-1.65	0.6-2.0	0.12-0.20	6.6-7.8	<2	Moderate	0.43			
	21-60	18-27	1.40-1.65	0.6-2.0	0.12-0.20	7.9-9.0	<2	Moderate	0.43			
DwB-------------- Duroc	0-7	15-20	1.20-1.45	0.6-2.0	0.12-0.22	6.6-7.8	<2	Moderate	0.28	5	5	1-3
	7-34	18-27	1.40-1.65	0.6-2.0	0.12-0.20	6.6-7.8	<2	Moderate	0.43			
	34-60	18-27	1.40-1.65	0.6-2.0	0.12-0.20	7.9-9.0	<2	Moderate	0.43			
EcF-------------- Eckley	0-7	10-20	1.30-1.35	2.0-6.0	0.09-0.12	6.6-7.3	<2	Low-------	0.15	2	5	2-4
	7-14	20-35	1.40-1.50	0.6-2.0	0.13-0.16	6.6-7.3	<2	Moderate	0.15			
	14-60	0-5	1.55-1.65	>6.0	0.03-0.06	6.6-7.8	<2	Low-------	0.10			
EkF-------------- Epping	0-5	10-20	1.20-1.45	0.6-2.0	0.18-0.24	6.6-8.4	<2	Low-------	0.43	2	4L	.5-2
	5-15	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low-------	0.43			
	15-60	---	---	0.06-0.2	---	---	---	----------	----			
Gg--------------- Glenberg	0-6	10-25	1.35-1.50	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low-------	0.32	5	4	.5-1
	6-60	8-18	1.50-1.70	2.0-6.0	0.07-0.12	7.4-9.0	<2	Low-------	0.10			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Go---------------- Goshen	0-12	15-24	1.35-1.55	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.28	5	5	1-3
	12-32	25-35	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.43			
	32-60	15-27	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
Ja---------------- Janise	0-2	10-20	1.20-1.30	0.6-2.0	0.15-0.17	7.9-9.0	<4	Low--------	0.32	5	4L	.5-1
	2-18	10-20	1.20-1.30	0.2-0.6	0.15-0.17	>9.0	<4	Moderate	0.32			
	18-42	10-25	1.20-1.40	0.6-2.0	0.14-0.17	>9.0	<4	Moderate	0.37			
	42-60	10-15	1.30-1.40	0.6-2.0	0.09-0.11	>9.0	<4	Low--------	0.24			
Ke, KeB, KeC----- Keith	0-9	14-20	1.25-1.45	0.6-2.0	0.20-0.23	6.1-7.3	<2	Low--------	0.28	5	5	1-3
	9-29	18-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-7.8	<2	Moderate	0.28			
	29-60	8-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.43			
Lc---------------- Lisco	0-6	5-10	1.40-1.50	2.0-6.0	0.13-0.18	>6.0	<4	Low--------	0.24	5	3	.5-2
	6-36	5-15	1.40-1.50	2.0-6.0	0.10-0.15	>8.4	>8	Low--------	0.24			
	36-60	3-10	1.50-1.60	2.0-20	0.05-0.14	>7.8	<4	Low--------	0.24			
Lo---------------- Lodgepole	0-5	16-25	1.20-1.40	0.6-2.0	0.22-0.24	6.1-7.8	<2	Low--------	0.37	3	6	1-3
	5-31	35-50	1.25-1.40	<0.06	0.13-0.18	6.1-7.8	<2	High-------	0.28			
	31-49	8-27	1.30-1.50	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low--------	0.43			
	49-60	5-20	1.40-1.50	2.0-6.0	0.10-0.18	7.4-8.4	<2	Low--------	0.17			
Mt, MtB, MtC, MtD-------------- Mitchell	0-7	10-20	1.30-1.60	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.43	5	3	.5-2
	7-60	8-18	1.20-1.60	0.6-2.0	0.16-0.22	7.4-8.4	<2	Low--------	0.43			
MxD*, MxE*: Mitchell----------	0-6	10-20	1.30-1.60	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low--------	0.43	5	3	.5-2
	6-60	8-18	1.20-1.60	0.6-2.0	0.16-0.22	7.4-8.4	<2	Low--------	0.43			
Epping------------	0-4	10-20	1.20-1.45	0.6-2.0	0.18-0.24	6.6-8.4	<2	Low--------	0.43	2	4L	.5-2
	4-14	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low--------	0.43			
	14-60	---	---	0.06-0.2	---	---	---	-----------	----			
OfB, OfD, OfE----- Otero	0-12	5-10	1.50-1.70	2.0-6.0	0.13-0.17	7.4-8.4	<2	Low--------	0.24	5	2	.5-1
	12-60	5-10	1.45-1.75	2.0-6.0	0.12-0.19	7.4-8.4	<2	Low--------	0.32			
OvG*: Otero------------	0-15	5-10	1.50-1.70	2.0-6.0	0.13-0.17	7.4-8.4	<2	Low--------	0.24	5	2	.5-1
	15-60	5-10	1.45-1.75	2.0-6.0	0.12-0.19	7.4-8.4	<2	Low--------	0.32			
Epping------------	0-4	10-20	1.20-1.45	0.6-2.0	0.18-0.24	6.6-8.4	<2	Low--------	0.43	2	4L	.5-2
	4-16	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low--------	0.43			
	16-60	---	---	0.06-0.2	---	---	---	-----------	----			
RaG*: Rock outcrop-----	0-12	---	---	0.2-0.6	---	---	---	-----------	----	---	---	---
Epping------------	0-4	10-20	1.20-1.45	0.6-2.0	0.18-0.24	6.6-8.4	<2	Low--------	0.43	2	4L	.5-2
	4-16	10-20	1.20-1.45	0.6-2.0	0.12-0.20	7.4-8.4	<2	Low--------	0.43			
	16-60	---	---	0.06-0.2	---	---	---	-----------	----			
RbB--------------- Rosebud	0-7	8-20	1.20-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low--------	0.28	4	5	2-4
	7-20	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.28			
	20-38	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-9.0	<2	Low--------	0.28			
	38-60	---	---	0.2-0.6	---	---	---	-----------	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
RcC*:												
Rosebud	0-7	8-20	1.20-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low	0.28	4	5	2-4
	7-25	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.28			
	25-31	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-9.0	<2	Low	0.28			
	31-60	---	---	0.2-0.6	---	---	---	---	---			
Canyon	0-6	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.32	2	4L	.5-2
	6-18	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low	0.20			
	18-60	---	---	0.2-0.6	---	---	---	---	---			
SaB, SaD: Sarben	0-7	8-15	1.40-1.60	2.0-6.0	0.09-0.11	6.1-7.3	<2	Low	0.24	5	2	.5-2
	7-29	10-18	1.20-1.40	2.0-6.0	0.15-0.17	6.6-7.8	<2	Low	0.24			
	29-60	10-18	1.20-1.40	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low	0.24			
StB: Satanta	0-5	5-15	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low	0.20	5	3	1-2
	5-25	18-35	1.35-1.45	0.6-2.0	0.16-0.19	6.6-8.4	<2	Moderate	0.28			
	25-47	5-15	1.30-1.40	0.6-2.0	0.12-0.18	7.4-8.4	<2	Low	0.32			
	47-60	2-15	1.45-1.55	6.0-20	0.08-0.10	7.4-8.4	<2	Low	0.17			
SvC*:												
Satanta	0-7	5-15	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low	0.20	5	3	1-2
	7-24	18-35	1.35-1.45	0.6-2.0	0.16-0.19	6.6-8.4	<2	Moderate	0.28			
	24-60	5-15	1.30-1.40	0.6-2.0	0.12-0.18	7.4-8.4	<2	Low	0.32			
Altvan	0-7	16-23	1.20-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low	0.28	4	5	1-2
	7-22	20-35	1.30-1.50	0.6-2.0	0.17-0.19	6.6-8.4	<2	Moderate	0.32			
	22-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-8.4	<2	Low	0.10			
SxC*, SxD*:												
Sidney	0-15	10-20	1.20-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	0.28	5	4L	1-3
	15-48	5-20	1.15-1.30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28			
	48-60	---	---	0.2-0.6	---	---	---	---	---			
Canyon	0-6	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.32	2	4L	.5-2
	6-14	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low	0.20			
	14-60	---	---	0.2-0.6	---	---	---	---	---			
SxD2*:												
Sidney	0-7	10-20	1.20-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low	0.28	5	4L	1-3
	7-48	5-20	1.15-1.30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28			
	48-60	---	---	0.2-0.6	---	---	---	---	---			
Canyon	0-4	10-20	1.25-1.45	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.32	2	4L	.5-2
	4-13	12-25	1.45-1.70	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low	0.20			
	13-60	---	---	0.2-0.6	---	---	---	---	---			
TcG*:												
Tassel	0-9	2-10	1.60-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low	0.24	2	2	.5-3
	9-16	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low	0.24			
	16-60	---	---	0.2-0.6	---	---	---	---	---			
Busher	0-9	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low	0.20	5	2	1-2
	9-48	5-12	1.40-1.60	2.0-6.0	0.13-0.19	6.6-8.4	<2	Low	0.28			
	48-60	---	---	0.2-0.6	---	---	---	---	---			
Rock outcrop	0-60	---	---	0.2-0.6	---	---	---	---	---	---	---	---
TfG*:												
Tassel	0-7	2-10	1.60-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low	0.24	2	2	.5-3
	7-15	5-12	1.40-1.70	2.0-6.0	0.12-0.18	7.4-8.4	<2	Low	0.24			
	15-60	---	---	0.2-0.6	---	---	---	---	---			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
TfG*:												
Rock outcrop	0-60	---	---	0.2-0.6	---	---	---	---	---	---	---	---
ToB, ToC	0-16	5-15	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.8	<2	Low	0.20	5	2	1-3
Tripp	16-30	13-18	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low	0.43			
	30-60	13-18	1.30-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low	0.32			
Tr, TrB, TrC, TrD	0-12	9-18	1.30-1.50	0.6-2.0	0.16-0.22	6.1-7.8	<2	Low	0.32	5	3	1-3
Tripp	12-21	13-18	1.30-1.50	0.6-2.0	0.16-0.24	6.6-7.8	<2	Low	0.43			
	21-60	13-18	1.30-1.50	0.6-2.0	0.16-0.24	7.4-8.4	<2	Low	0.43			
VaD, VaE	0-5	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15	5	1	.5-1
Valent	5-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15			
VdB, VdD	0-7	3-10	1.55-1.65	6.0-20	0.07-0.12	6.6-7.8	<2	Low	0.17	5	2	.5-1
Valent	7-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	<2	Low	0.15			
VnC	0-14	10-18	1.25-1.40	2.0-6.0	0.11-0.17	5.6-7.8	<2	Low	0.20	5	3	1-3
Vetal	14-36	12-18	1.25-1.40	2.0-6.0	0.11-0.17	6.1-7.8	<2	Low	0.20			
	36-60	10-18	1.30-1.40	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low	0.20			
VtB	0-30	10-18	1.20-1.30	2.0-6.0	0.17-0.21	5.6-7.8	<2	Low	0.28	5	3	1-3
Vetal	30-40	12-18	1.25-1.40	2.0-6.0	0.11-0.17	6.1-7.8	<2	Low	0.20			
	40-60	10-18	1.30-1.40	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low	0.20			
Yp	0-6	8-18	1.40-1.50	0.6-2.0	0.19-0.24	7.4-8.4	<4	Low	0.37	5	4L	.5-2
Yockey	6-60	5-15	1.40-1.65	0.6-2.0	0.11-0.17	>8.4	4-16	Low	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
AcB, AcC, AcD----- Alice	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Ae, AeB, AeC, AeD2------------- Alliance	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
AgC--------------- Altvan	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
AhD*:												
Altvan-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Eckley-----------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
Bb---------------- Bankard	A	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low------	Moderate	Low.
Bc---------------- Bankard	A	Frequent----	Brief-----	Mar-Jun	>6.0	---	---	>60	---	Low------	High-----	Low.
BdB, BdC, BdD, BdE-------------- Bayard	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
BeD*, BeE*:												
Bayard-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Dix--------------	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Bg, BgB----------- Bridget	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
BgC, BgD, BgE----- Bridget	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
BxE*:												
Busher-----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	Low------	Low.
Tassel-----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	Low------	Low.
CaF--------------- Canyon	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
CgG*:												
Canyon-----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	Low------	Low.
Rock outcrop-----	D	None--------	---	---	>6.0	---	---	0-1	Soft	Low------	---	---
CnE*, CnE2*:												
Canyon-----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	Low------	Low.
Sidney-----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
CrB, CrC---------- Creighton	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
DtB--------------- Dix	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Dw---------------- Duroc	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
DwB--------------- Duroc	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
EcF--------------- Eckley	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
EkF--------------- Epping	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	Low------	Low.
Gg---------------- Glenberg	B	Occasional	Very brief	Apr-Aug	>6.0	---	---	>60	---	Low------	High-----	Low.
Go---------------- Goshen	B	Rare--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Ja---------------- Janise	C	Occasional	Brief-----	Feb-Jun	2.0-3.0	Apparent	Dec-Jul	>60	---	High-----	High-----	High.
Ke, KeB, KeC------ Keith	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Lc---------------- Lisco	C	Rare--------	---	---	1.5-3.5	Apparent	Feb-May	>60	---	Moderate	High-----	High.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Lo: Lodgepole	D	None	---	---	+.5-1.0	Perched	Apr-Jun	>60	---	High	High	Low.
Mt, MtB, MtC, MtD: Mitchell	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
MxD*, MxE*:												
Mitchell	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Epping	D	None	---	---	>6.0	---	---	10-20	Soft	Low	Low	Low.
OfB, OfD, OfE: Otero	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
OvG*:												
Otero	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Epping	D	None	---	---	>6.0	---	---	10-20	Soft	Low	Low	Low.
RaG*:												
Rock outcrop	D	None	---	---	>6.0	---	---	0-1	Soft	Low	---	---
Epping	D	None	---	---	>6.0	---	---	10-20	Soft	Low	Low	Low.
RbB: Rosebud	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
RcC*:												
Rosebud	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	Low	Low.
SaB, SaD: Sarben	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
StB: Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
SvC*:												
Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Altvan	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
SxC*, SxD*, SxD2*:												
Sidney	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	High	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
SxC*, SxD*, SxD2*:												
Canyon-----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	Low------	Low.
TcG*:												
Tassel-----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	Low------	Low.
Busher-----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	Low------	Low.
Rock outcrop-----	D	None--------	---	---	>6.0	---	---	0-1	Soft	Low------	---	---
TfG*:												
Tassel-----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	Low------	Low.
Rock outcrop-----	D	None--------	---	---	>6.0	---	---	0-1	Soft	Low------	---	---
ToB, ToC, Tr, TrB, TrC, TrD--------- Tripp	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
VaD, VaE, VdB, VdD-------------- Valent	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
VnC, VtB---------- Vetal	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Yp---------------- Yockey	C	Occasional	Brief-----	Feb-Jun	2.0-4.0	Apparent	Nov-May	>60	---	Moderate	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available. LL means liquid limit; PI, plasticity index; and NP, nonplastic)

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution**											
			Percentage passing sieve--						Percentage smaller than--			LL	PI	Specific gravity
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm	Pct		
Alliance: (S82NE007-1)														
Ap----- 0 to 7	A-4(6)	ML, CL-ML	---	---	100	99	90	64	49	13	8	26	4	2.60
Bt2---- 17 to 25	A-6(10)	CL	---	---	---	100	96	80	66	25	16	34	14	2.63
C------ 36 to 44	A-4(5)	ML	---	100	99	97	87	61	47	10	5	24	2	2.62
Bridget: (S87NE007-22)														
Ap----- 0 to 7	A-4(8)	ML, CL-ML	---	---	---	100	99	86	74	---	9	27	5	2.57
AC----- 14 to 26	A-4(8)	ML	---	---	---	100	97	79	63	---	9	30	4	2.60
C2----- 48 to 60	A-4(8)	ML	---	---	---	100	98	83	70	---	7	27	2	2.60
Mitchell: (S85NE007-4)														
Ap----- 0 to 7	A-4(7)	ML	---	---	---	100	99	69	37	---	4	27	NP	2.56
C------ 12 to 60	A-4(6)	ML	---	100	99	99	95	67	39	---	5	26	NP	2.57
Rosebud: (S82NE007-2)														
Ap----- 0 to 7	A-4(7)	CL	100	99	99	98	92	71	58	25	9	30	8	2.63
Bk----- 17 to 25	A-6(8)	CL	---	---	---	100	96	81	68	17	10	36	11	2.63
Sarben: (S85NE007-9)														
A------ 0 to 8	A-4(5)	ML	---	---	---	---	100	61	31	---	7	28	NP	2.57
C1----- 16 to 37	A-4(3)	SM	---	---	---	100	99	49	15	---	6	25	NP	2.59
Sidney: (S87NE007-34)														
Ap----- 0 to 7	A-4(8)	CL-ML, CL	---	---	---	100	96	73	57	---	14	27	5	2.60
Bw----- 7 to 16	A-4(7)	ML	---	---	---	100	95	70	54	---	15	30	6	2.63
C------ 26 to 48	A-4(6)	ML	---	---	100	98	93	65	48	---	10	27	4	2.66
C2----- 48 to 60	A-4(8)	ML	---	---	---	100	98	83	70	---	7	27	2	2.60
Tripp: (S85NE007-3)														
Ap----- 0 to 7	A-4(8)	ML	---	---	---	---	100	84	57	---	11	28	4	2.56
Bw----- 12 to 21	A-4(8)	ML	---	---	---	---	100	87	70	---	12	30	5	2.57
BCk---- 21 to 30	A-4(8)	ML	---	---	---	---	100	89	71	---	10	33	7	2.62
C------ 30 to 60	A-4(8)	ML	---	---	---	---	100	89	76	---	6	30	2	2.59

See footnotes at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution**									LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		
Valent: (S85NE007-5)														
A------ 0 to 4	A-2-4(0)	SM	---	---	---	100	96	33	18	---	2	22	NP	2.61
C------ 10 to 60	A-2-4(0)	SM	---	---	---	100	94	18	5	---	1	NP	NP	2.62

* Locations of the sampled pedons are as follows--

Alliance loam: 850 feet west and 400 feet north of the southeast corner of sec. 12, T. 17 N., R. 57 W.

Bridget very fine sandy loam: 1,320 feet north and 200 feet east of the southwest corner of sec. 36, T. 19 N., R. 55 W.

Mitchell very fine sandy loam: 1,300 feet west and 50 feet north of the southeast corner of sec. 6, T. 18 N., R. 53 W.

Rosebud loam: 2,225 feet west and 1,300 feet south of the northeast corner of sec. 12, T. 17 N., R. 56 W.

Sarben loamy very fine sand: 700 feet east and 1,850 feet north of the southwest corner of sec. 20, T. 20 N., R. 56 W.

Sidney loam: 2,500 feet east and 1,700 feet north of the southwest corner of sec. 10, T. 17 N., R. 55 W.

Tripp very fine sandy loam: 150 feet east and 150 feet north of the southwest corner of sec. 23, T. 19 N., R. 54 W.

Valent loamy fine sand: 1,050 feet east and 1,350 feet south of the northwest corner of sec. 20, T. 19 N., R. 53 W.

** The results of testing by American Association of State Highway Officials (AASHTO) methods may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material. In the SCS soil survey procedure, the organic matter is removed from the fine material and calcareous material may be treated to remove carbonates. The fine material is then analyzed by the pipette method, and the grain-size fractions are calculated and reported for the fraction less than 2 millimeters in size.

TABLE 20.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Alice	Coarse-loamy, mixed, mesic Aridic Haplustolls
Alliance	Fine-silty, mixed, mesic Aridic Argiustolls
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Bayard	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Bridget	Coarse-silty, mixed, mesic Torriorthentic Haplustolls
Busher	Coarse-loamy, mixed, mesic Aridic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Creighton	Coarse-loamy, mixed, mesic Aridic Haplustolls
Dix	Sandy-skeletal, mixed, mesic Torriorthentic Haplustolls
Duroc	Fine-silty, mixed, mesic Pachic Haplustolls
Eckley	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Epping	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Goshen	Fine-silty, mixed, mesic Pachic Argiustolls
Janise	Coarse-silty, mixed (calcareous), mesic Typic Halaquepts
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Lisco	Coarse-loamy, mixed (calcareous), mesic Typic Halaquepts
Lodgepole	Fine, montmorillonitic, mesic Typic Argiaquolls
Mitchell	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Otero	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents
*Rosebud	Fine-loamy, mixed, mesic Aridic Argiustolls
Sarben	Coarse-loamy, mixed, nonacid, mesic Aridic Ustorthents
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Sidney	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Tripp	Coarse-silty, mixed, mesic Aridic Haplustolls
Valent	Mixed, mesic Ustic Torripsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls
Yockey	Coarse-silty, mixed (calcareous), mesic Aquic Ustifluvents

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Map symbol and soil name	Land capability N	Land capability I	Prime farmland*	Range site	Windbreak suitability group
AcB: Alice	IIIe-3	IIe-8	Yes	Sandy	5
AcC: Alice	IVe-3	IIIe-8	Yes	Sandy	5
AcD: Alice	IVe-3	IVe-8	---	Sandy	5
Ae: Alliance	IIIc-1	I-4	Yes	Silty	3
AeB: Alliance	IIIe-1	IIe-4	Yes	Silty	3
AeC: Alliance	IIIe-1	IIIe-4	Yes	Silty	3
AeD2: Alliance	IVe-8	IVe-4	---	Silty	3
AgC: Altvan	IVe-1	IVe-7	Yes	Silty	6G
AhD:	IVe-1	IVe-7	---		
Altvan				Silty	6G
Eckley				Shallow to Gravel	10
Bb: Bankard	IVw-5	IVw-11	---	Sandy Lowland	7
Bc: Bankard	VIw-7	---	---	---	10
BdB: Bayard	IIIe-3	IIe-8	Yes	Sandy	5
BdC: Bayard	IVe-3	IIIe-8	Yes	Sandy	5
BdD: Bayard	IVe-3	IVe-8	---	Sandy	5
BdE: Bayard	VIe-3	---	---	Sandy	7
BeD:	IVe-3	IVe-8	---		
Bayard				Sandy	5
Dix				Shallow to Gravel	10
BeE:	VIe-3	---	---		
Bayard				Sandy	7
Dix				Shallow to Gravel	10
Bg: Bridget	IIIc-1	IIe-6	Yes	Silty	3

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability N	Land capability I	Prime farmland*	Range site	Windbreak suitability group
BgB-------------------------- Bridget	IIIe-3	IIe-6	Yes	Silty----------------	3
BgC-------------------------- Bridget	IIIe-3	IIIe-6	Yes	Silty----------------	3
BgD-------------------------- Bridget	IVe-3	IVe-6	---	Silty----------------	3
BgE-------------------------- Bridget	VIe-3	---	---	Silty----------------	3
BxE--------------------------	VIe-5	---	---		
Busher----------------------				Sandy----------------	7
Tassel----------------------				Shallow Limy---------	10
CaF-------------------------- Canyon	VIs-4	---	---	Shallow Limy---------	10
CgG--------------------------	VIIs-4	---	---		
Canyon----------------------				Shallow Limy---------	10
Rock outcrop.					
CnE--------------------------	VIs-4	---	---		
Canyon----------------------				Shallow Limy---------	10
Sidney----------------------				Silty----------------	3
CnE2-------------------------	VIs-4	---	---		
Canyon----------------------				Shallow Limy---------	10
Sidney----------------------				Silty----------------	3
CrB-------------------------- Creighton	IIIe-3	IIe-6	Yes	Silty----------------	3
CrC-------------------------- Creighton	IIIe-3	IIIe-6	Yes	Silty----------------	3
DtB-------------------------- Dix	VIs-4	IVs-14	---	Shallow to Gravel----	10
Dw--------------------------- Duroc	IIIc-1	I-6	Yes	Silty----------------	1
DwB-------------------------- Duroc	IIIe-1	IIe-6	Yes	Silty----------------	3
EcF-------------------------- Eckley	VIs-4	---	---	Shallow to Gravel----	10
EkF-------------------------- Epping	VIs-4	---	---	Shallow Limy---------	10
Gg--------------------------- Glenberg	IIIw-3	IIw-8	Yes	Sandy Lowland--------	1L
Go--------------------------- Goshen	IIIc-1	I-4	Yes	Silty Lowland--------	1
Ja--------------------------- Janise	VIs-1	---	---	Saline Subirrigated--	10

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability N	Land capability I	Prime farmland*	Range site	Windbreak suitability group
Ke---------------------------- Keith	IIIc-1	I-4	Yes	Silty-----------------	3
KeB--------------------------- Keith	IIIe-1	IIe-4	Yes	Silty-----------------	3
KeC--------------------------- Keith	IIIe-1	IIIe-4	Yes	Silty-----------------	3
Lc---------------------------- Lisco	VIs-1	---	---	Saline Subirrigated--	10
Lo---------------------------- Lodgepole	IIIw-2	IVw-2	---	Clayey Overflow------	2W
Mt---------------------------- Mitchell	IIIc-1	IIe-6	Yes	Limy Upland----------	8
MtB--------------------------- Mitchell	IIIe-3	IIe-6	Yes	Limy Upland----------	8
MtC--------------------------- Mitchell	IIIe-3	IIIe-6	Yes	Limy Upland----------	8
MtD--------------------------- Mitchell	IVe-3	IVe-6	---	Limy Upland----------	8
MxD---------------------------	IVe-3	IVe-6	Yes		
Mitchell---------------------				Limy Upland----------	8
Epping-----------------------				Shallow Limy---------	10
MxE---------------------------	VIe-3	---	---		
Mitchell---------------------				Limy Upland----------	8
Epping-----------------------				Shallow Limy---------	10
OfB--------------------------- Otero	IVe-5	IIIe-10	---	Sandy-----------------	8
OfD--------------------------- Otero	IVe-5	IVe-10	---	Sandy-----------------	8
OfE--------------------------- Otero	VIe-5	---	---	Sandy-----------------	8
OvG---------------------------	VIIe-5	---	---		
Otero------------------------				Sandy-----------------	10
Epping-----------------------				Shallow Limy---------	10
RaG---------------------------	VIIs-3	---	---		
Rock outcrop.					
Epping-----------------------				Shallow Limy---------	10
RbB--------------------------- Rosebud	IIIe-1	IIIe-4	Yes	Silty-----------------	6R
RcC---------------------------	IVe-1	IVe-4	---		
Rosebud----------------------				Silty-----------------	6R
Canyon-----------------------				Shallow Limy---------	10
SaB--------------------------- Sarben	IVe-5	IIIe-10	---	Sandy-----------------	5

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability N	Land capability I	Prime farmland*	Range site	Windbreak suitability group
SaD: Sarben	IVe-5	IVe-10	---	Sandy	5
StB: Satanta	IIIe-3	IIe-5	Yes	Silty	5
SvC:	IIIe-3	IIIe-5	Yes		
Satanta				Silty	5
Altvan				Silty	6G
SxC:	IVe-1	IIIe-6	---		
Sidney				Silty	3
Canyon				Shallow Limy	10
SxD:	IVe-1	IVe-6	---		
Sidney				Silty	3
Canyon				Shallow Limy	10
SxD2:	IVe-8	IIIe-6	---		
Sidney				Silty	3
Canyon				Shallow Limy	10
TcG:	VIIs-4	---	---		
Tassel				Shallow Limy	10
Busher				Savannah	10
Rock outcrop.					
TfG:	VIIs-4	---	---		
Tassel				Shallow Limy	10
Rock outcrop.					
ToB: Tripp	IVe-5	IIIe-10	---	Sandy	5
ToC: Tripp	IVe-5	IVe-10	---	Sandy	5
Tr: Tripp	IIIc-1	IIe-6	Yes	Silty	3
TrB: Tripp	IIIe-3	IIe-6	Yes	Silty	3
TrC: Tripp	IIIe-3	IIIe-6	Yes	Silty	3
TrD: Tripp	IVe-3	IVe-6	---	Silty	3
VaD: Valent	VIe-5	IVe-12	---	Sands	7
VaE: Valent	VIe-5	---	---	Sands	7
VdB: Valent	VIe-5	IVe-11	---	Sandy	7
VdD: Valent	VIe-5	IVe-11	---	Sands	7

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability N	Land capability I	Prime farmland*	Range site	Windbreak suitability group
VnC---------------------------- Vetal	IVe-3	IIIe-8	Yes	Sandy----------------	5
VtB---------------------------- Vetal	IIIe-3	IIe-8	Yes	Sandy----------------	5
Yp----------------------------- Yockey	IVs-1	IIIs-6	---	Saline Subirrigated--	9S

* Where irrigated.

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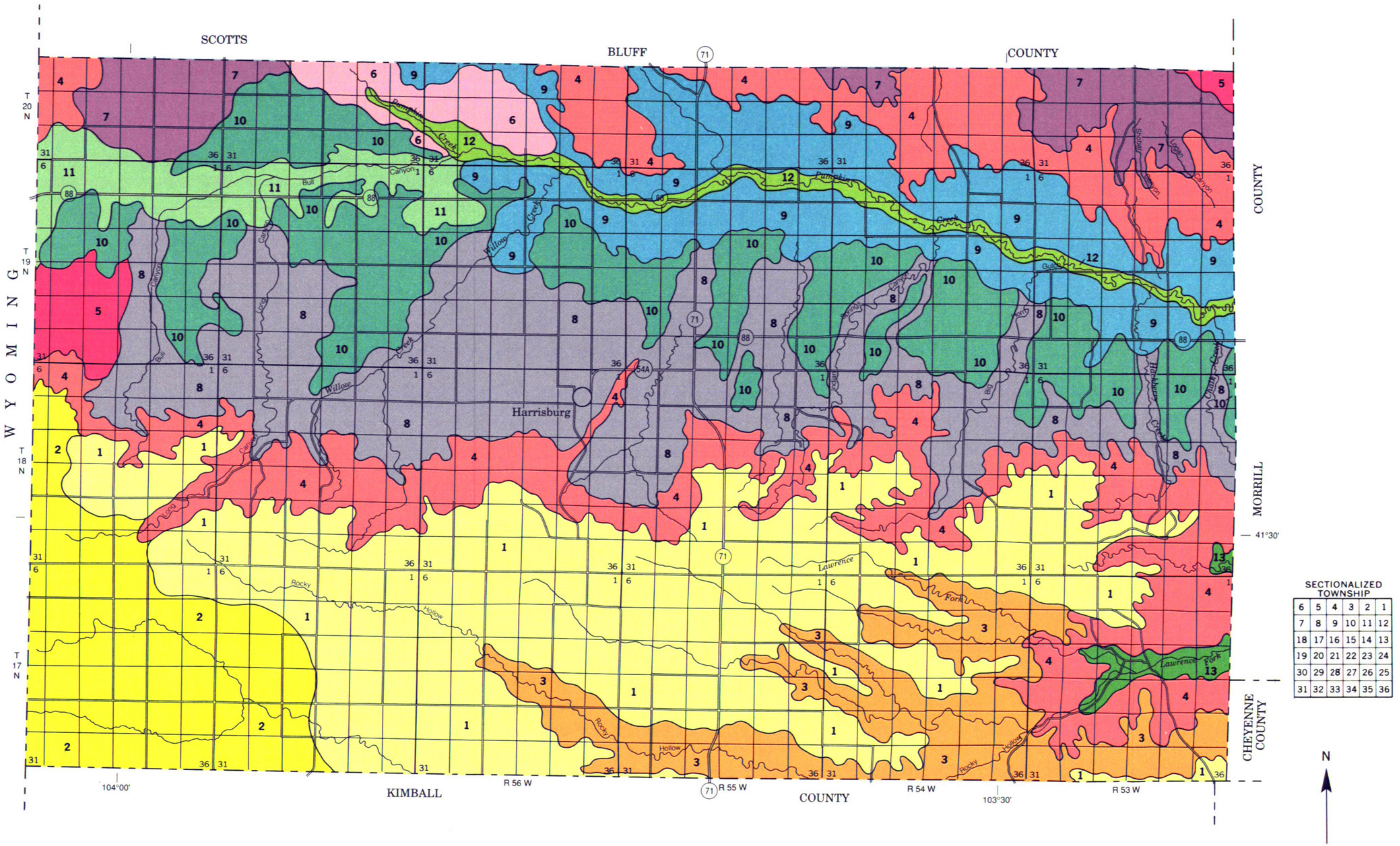


SOIL LEGEND*

NEARLY LEVEL TO VERY STEEP, LOAMY SOILS ON UPLANDS

1 Alliance-Keith-Sidney association

2 Satanta-Alliance-Canyon association

3 Canyon-Rock outcrop association

NEARLY LEVEL TO VERY STEEP, SANDY SOILS ON UPLANDS

4 Tassel-Busher-Rock outcrop association

5 Valent association

6 Valent-Sarben association

NEARLY LEVEL TO MODERATELY STEEP, LOAMY AND SANDY SOILS ON FOOT SLOPES, ALLUVIAL FANS, AND STREAM TERRACES AND IN SWALES

7 Bridget-Otero association

8 Bayard-Bridget association

9 Otero-Bayard-Sarben association

10 Tripp-Alice association

11 Vetal-Bayard association

NEARLY LEVEL TO GENTLY SLOPING, LOAMY AND SANDY SOILS ON ALLUVIAL FANS, STREAM TERRACES, AND BOTTOM LAND

12 Janise-Yockey, alkali-Lisco association

13 Bankard-Bayard association

* The units on this legend are described in the text under the heading "General Soil Map Units."

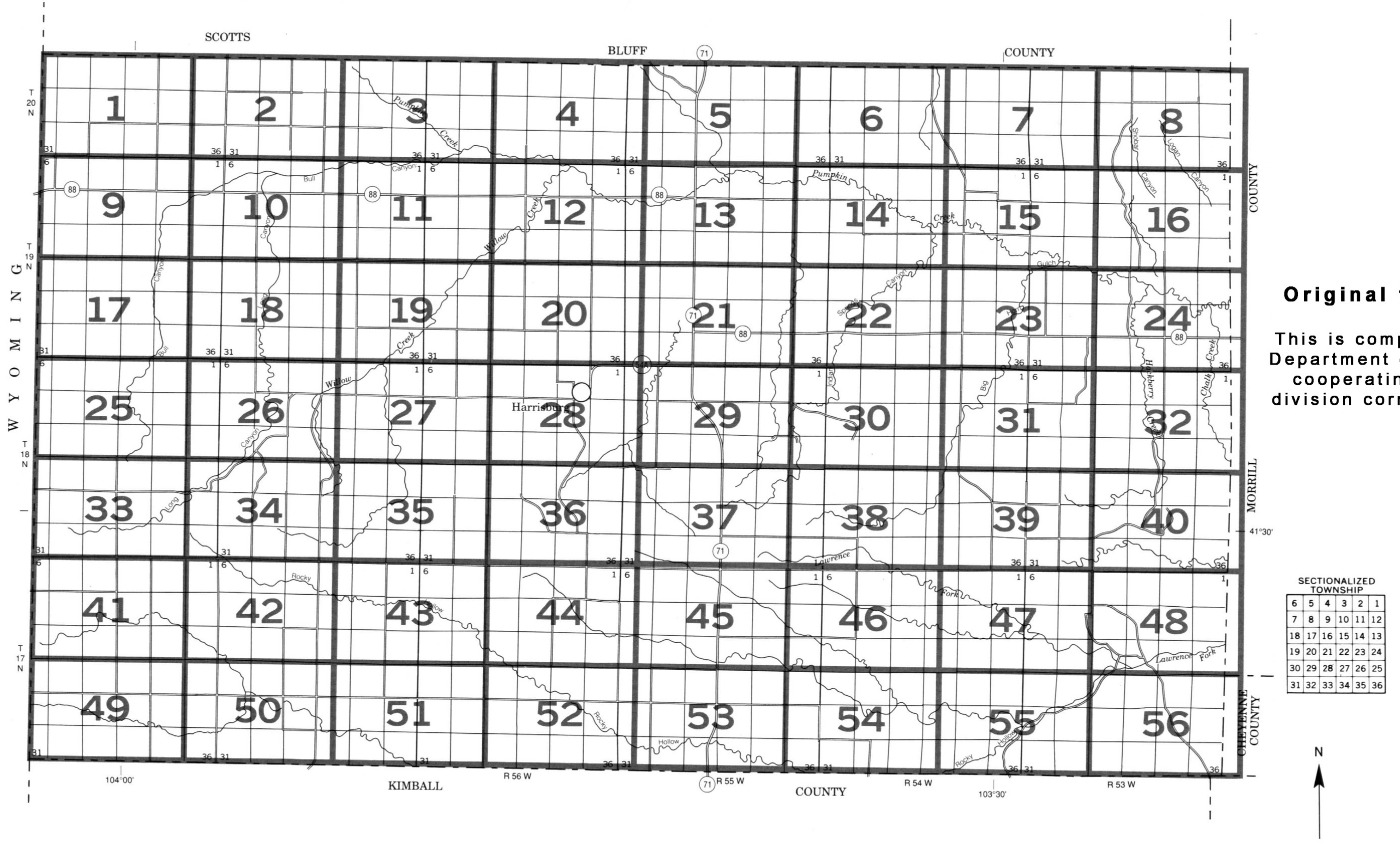
Compiled 1991

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA
CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP

BANNER COUNTY, NEBRASKA

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:

This is compiled on 1977 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

INDEX TO MAP SHEETS

BANNER COUNTY, NEBRASKA

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is moderately eroded.

SYMBOL	NAME
AcB	Alice fine sandy loam, 0 to 3 percent slopes
AcC	Alice fine sandy loam, 3 to 6 percent slopes
AcD	Alice fine sandy loam, 6 to 9 percent slopes
Ae	Alliance loam, 0 to 1 percent slopes
AeB	Alliance loam, 1 to 3 percent slopes
AeC	Alliance loam, 3 to 6 percent slopes
AeD2	Alliance loam, 6 to 9 percent slopes, eroded
AgC	Altvan loam, 3 to 6 percent slopes
AhD	Altvan-Eckley complex, 3 to 9 percent slopes
Bb	Bankard loamy fine sand, 0 to 2 percent slopes
Bc	Bankard fine sand, channeled
BdB	Bayard very fine sandy loam, 1 to 3 percent slopes
BdC	Bayard very fine sandy loam, 3 to 6 percent slopes
BdD	Bayard very fine sandy loam, 6 to 9 percent slopes
BdE	Bayard very fine sandy loam, 9 to 20 percent slopes
BeD	Bayard-Dix complex, 3 to 9 percent slopes
BeE	Bayard-Dix complex, 9 to 20 percent slopes
Bg	Bridget very fine sandy loam, 0 to 1 percent slopes
BgB	Bridget very fine sandy loam, 1 to 3 percent slopes
BgC	Bridget very fine sandy loam, 3 to 6 percent slopes
BgD	Bridget very fine sandy loam, 6 to 9 percent slopes
BgE	Bridget very fine sandy loam, 9 to 20 percent slopes
BxE	Busher-Tassel loamy very fine sands, 9 to 20 percent slopes
CaF	Canyon loam, 9 to 30 percent slopes
CgG	Canyon-Rock outcrop complex, 20 to 60 percent slopes
CnE	Canyon-Sidney loams, 9 to 20 percent slopes
CnE2	Canyon-Sidney loams, 9 to 20 percent slopes, eroded
CrB	Creighton very fine sandy loam, 1 to 3 percent slopes
CrC	Creighton very fine sandy loam, 3 to 6 percent slopes
DtB	Dix sandy loam, 0 to 3 percent slopes
Dw	Duroc loam, 0 to 1 percent slopes
DwB	Duroc loam, 1 to 3 percent slopes
EcF	Eckley gravelly sandy loam, 3 to 30 percent slopes
EkF	Epping silt loam, 9 to 30 percent slopes
Gg	Glenberg very fine sandy loam, 0 to 2 percent slopes
Go	Goshen loam, 0 to 1 percent slopes
Ja	Janise loam, 0 to 2 percent slopes
Ke	Keith loam, 0 to 1 percent slopes
KeB	Keith loam, 1 to 3 percent slopes
KeC	Keith loam, 3 to 6 percent slopes

SYMBOL	NAME
Lc	Lisco fine sandy loam, 0 to 2 percent slopes
Lo	Lodgepole silt loam, 0 to 1 percent slopes
Mt	Mitchell very fine sandy loam, 0 to 1 percent slopes
MtB	Mitchell very fine sandy loam, 1 to 3 percent slopes
MtC	Mitchell very fine sandy loam, 3 to 6 percent slopes
MtD	Mitchell very fine sandy loam, 6 to 9 percent slopes
MxD	Mitchell-Epping complex, 3 to 9 percent slopes
MxE	Mitchell-Epping complex, 9 to 20 percent slopes
OfB	Otero loamy very fine sand, 0 to 3 percent slopes
OfD	Otero loamy very fine sand, 3 to 9 percent slopes
OfE	Otero loamy very fine sand, 9 to 20 percent slopes
OvG	Otero-Epping complex, 9 to 60 percent slopes
RaG	Rock outcrop-Epping complex, 20 to 60 percent slopes
RbB	Rosebud loam, 1 to 3 percent slopes
RcC	Rosebud-Canyon loams, 3 to 6 percent slopes
SaB	Sarben loamy very fine sand, 0 to 3 percent slopes
SaD	Sarben loamy very fine sand, 3 to 9 percent slopes
StB	Satanta fine sandy loam, 1 to 3 percent slopes
SvC	Satanta-Altvan complex, 3 to 6 percent slopes
SxC	Sidney-Canyon loams, 3 to 6 percent slopes
SxD	Sidney-Canyon loams, 6 to 9 percent slopes
SxD2	Sidney-Canyon loams, 6 to 9 percent slopes, eroded
TcG	Tassel-Busher-Rock outcrop complex, 20 to 60 percent slopes
TfG	Tassel-Rock outcrop complex, 20 to 60 percent slopes
ToB	Tripp loamy very fine sand, overblown, 0 to 3 percent slopes
ToC	Tripp loamy very fine sand, overblown, 3 to 6 percent slopes
Tr	Tripp very fine sandy loam, 0 to 1 percent slopes
TrB	Tripp very fine sandy loam, 1 to 3 percent slopes
TrC	Tripp very fine sandy loam, 3 to 6 percent slopes
TrD	Tripp very fine sandy loam, 6 to 9 percent slopes
VaD	Valent fine sand, 3 to 9 percent slopes
VaE	Valent fine sand, rolling
VdB	Valent loamy fine sand, 0 to 3 percent slopes
VdD	Valent loamy fine sand, 3 to 9 percent slopes
VnC	Vetal fine sandy loam, 3 to 6 percent slopes
VtB	Vetal very fine sandy loam, 0 to 3 percent slopes
Yp	Yockey loam, alkali, 0 to 2 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- State
- County
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- State — 52
- County, farm or ranch — 378

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit (up to 5 acres)

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Located object (label) — Tower

WATER FEATURES

DRAINAGE

- Perennial, single line
- Intermittent
- Drainage end

LAKES, PONDS AND RESERVOIRS

- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh (up to 3 acres)
- Spring
- Well, irrigation
- Wet spot (up to 3 acres)

SPECIAL SYMBOLS FOR SOIL SURVEY

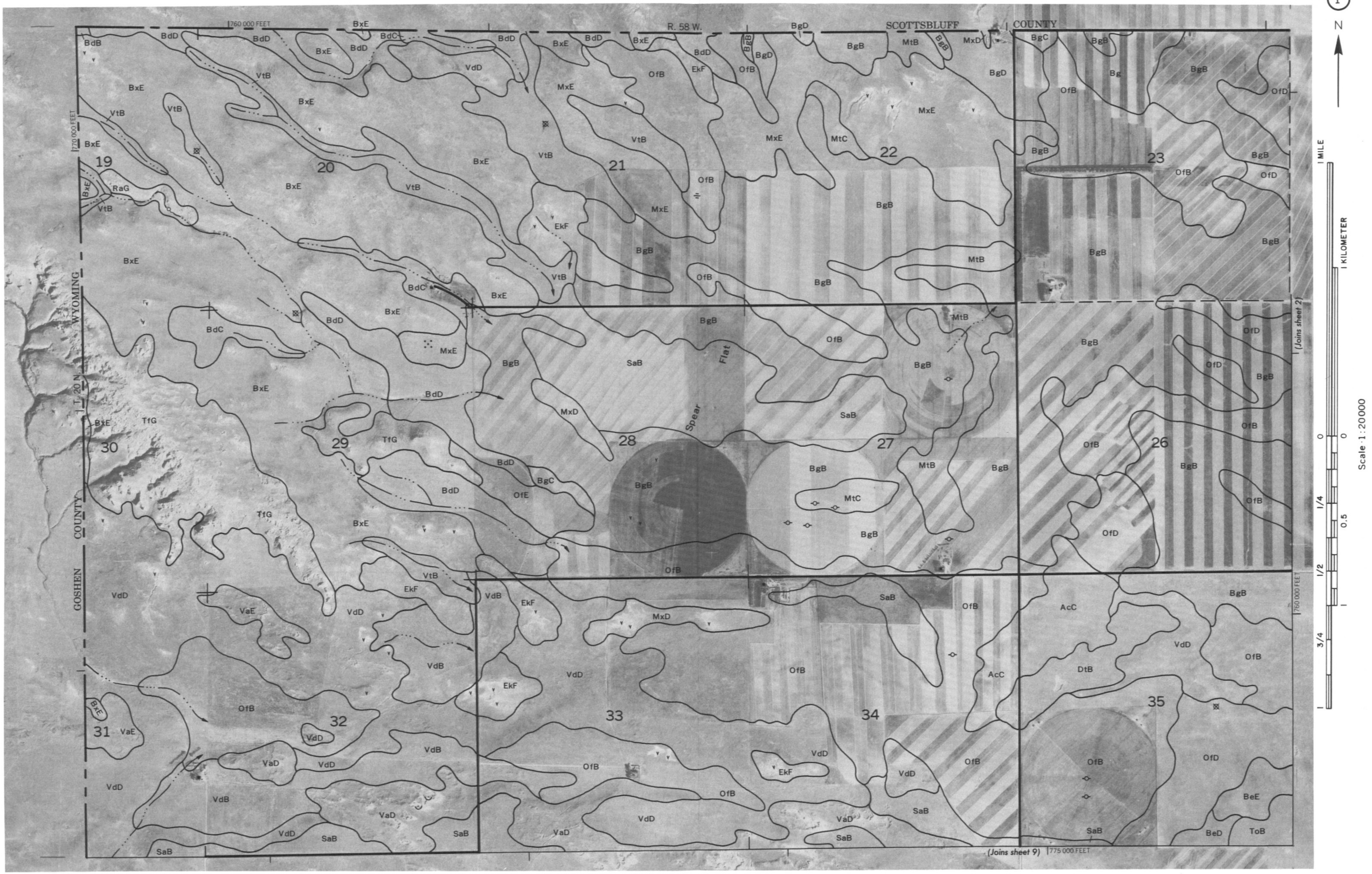
SOIL DELINEATIONS AND SYMBOLS — TfG, SxD2

GULLY

DEPRESSION (up to 3 acres)

MISCELLANEOUS

- Blowout (up to 3 acres)
- Gravelly spot (up to 3 acres)
- Gumbo, slick or scabby spot (sodic) (up to 3 acres)
- Prominent hill or peak
- Rock outcrop (up to 3 acres) (includes sandstone and shale)
- Saline spot (up to 3 acres)
- Sandy spot (up to 3 acres)
- Severely eroded spot (up to 3 acres)
- Livestock watering facility


1
N
SCOTTSBLUFF COUNTY
R. 58 W.
760 000 FEET
720 000 FEET
T. 20 N.
WYOMING
GOSHEN COUNTY
Spear Flat
(Joins sheet 2)
(Joins sheet 9)
775 000 FEET
760 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
19
20
21
22
23
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27
28
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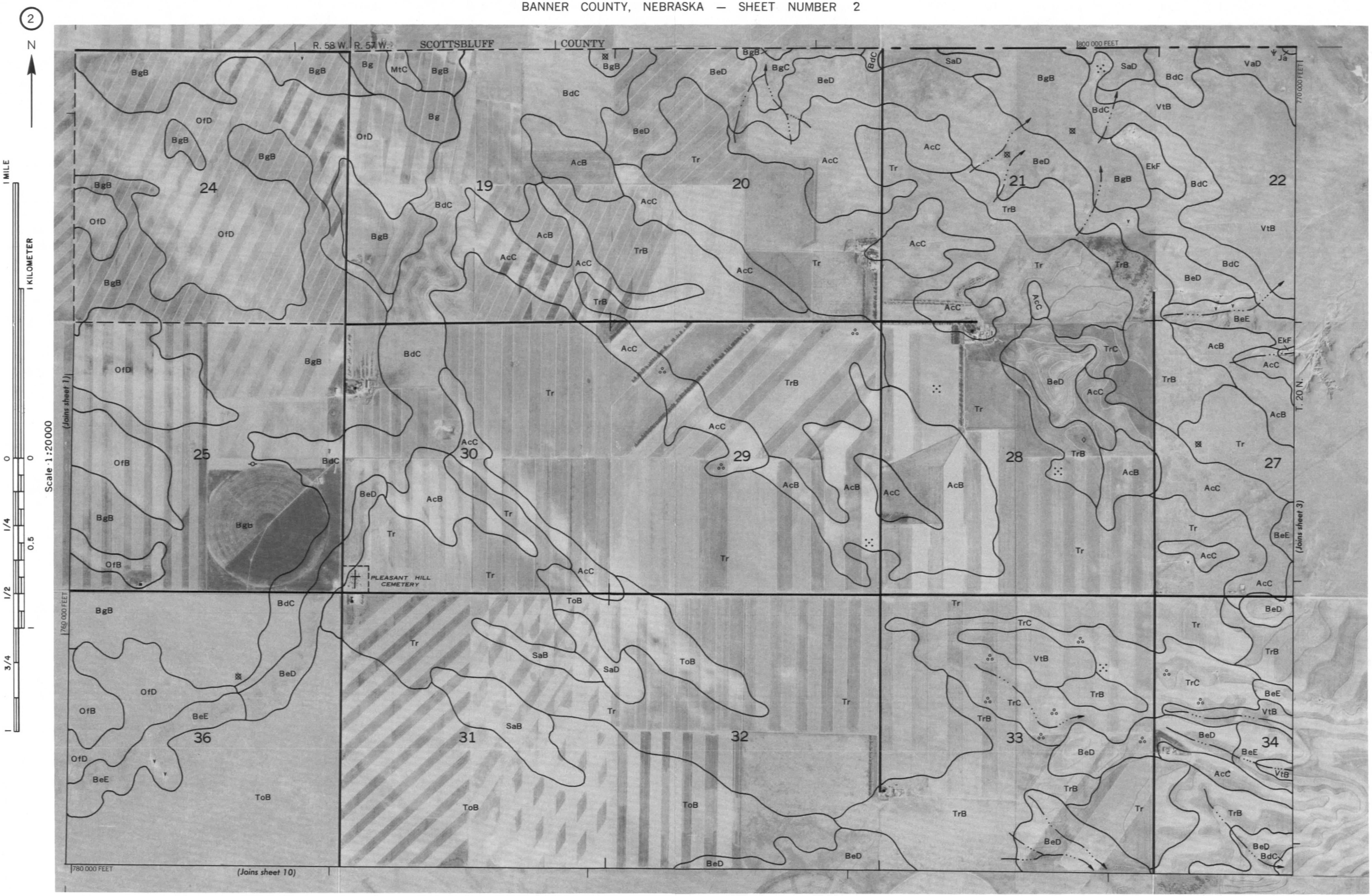
31
32
33
34
35


2
N
1 MILE
1 KILOMETER
Scale 1:20000
R. 58 W.
R. 57 W.
SCOTTSBLUFF
COUNTY
800 000 FEET
770 000 FEET
760 000 FEET
780 000 FEET
T. 20 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 10)
PLEASANT HILL CEMETERY
19
20
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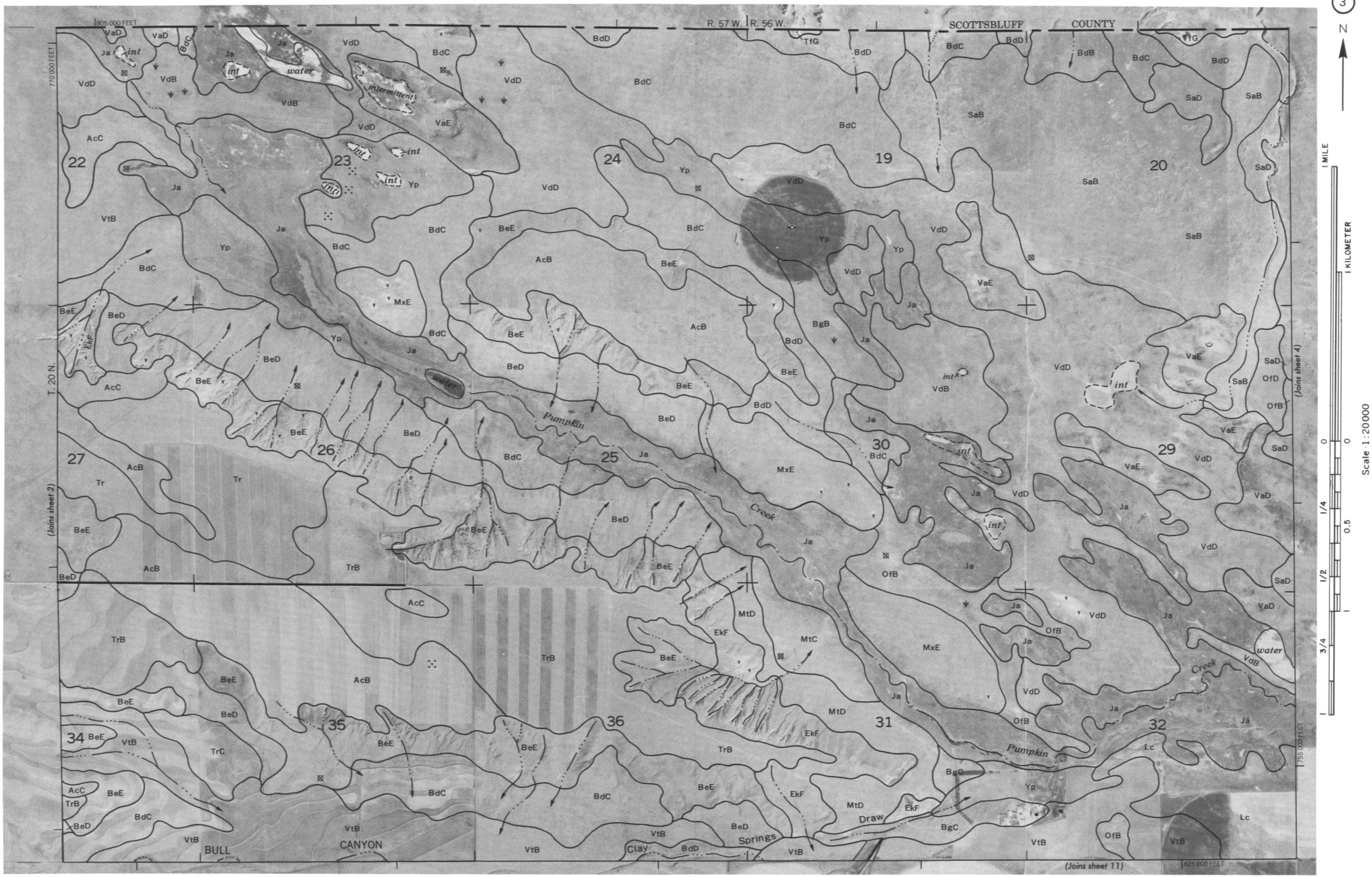
36


3
N
R. 57 W. R. 56 W.
SCOTTSBLUFF COUNTY
805 000 FEET
770 000 FEET
T. 20 N.
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 11)
755 000 FEET
825 000 FEET
Pumpkin Creek
Bull Canyon
Clay Springs Draw
1 MILE
1 KILOMETER
Scale 1:20 000
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23
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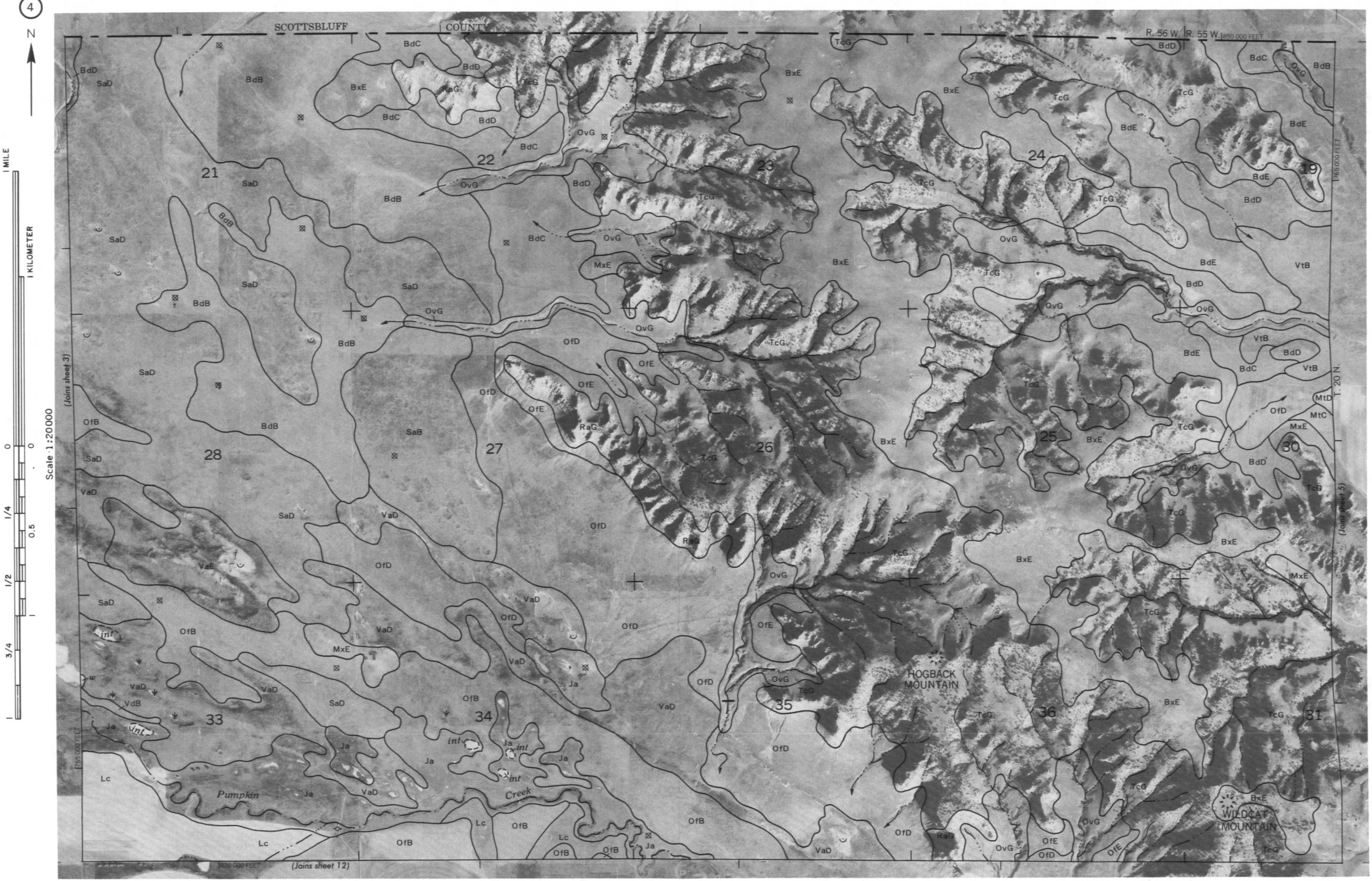
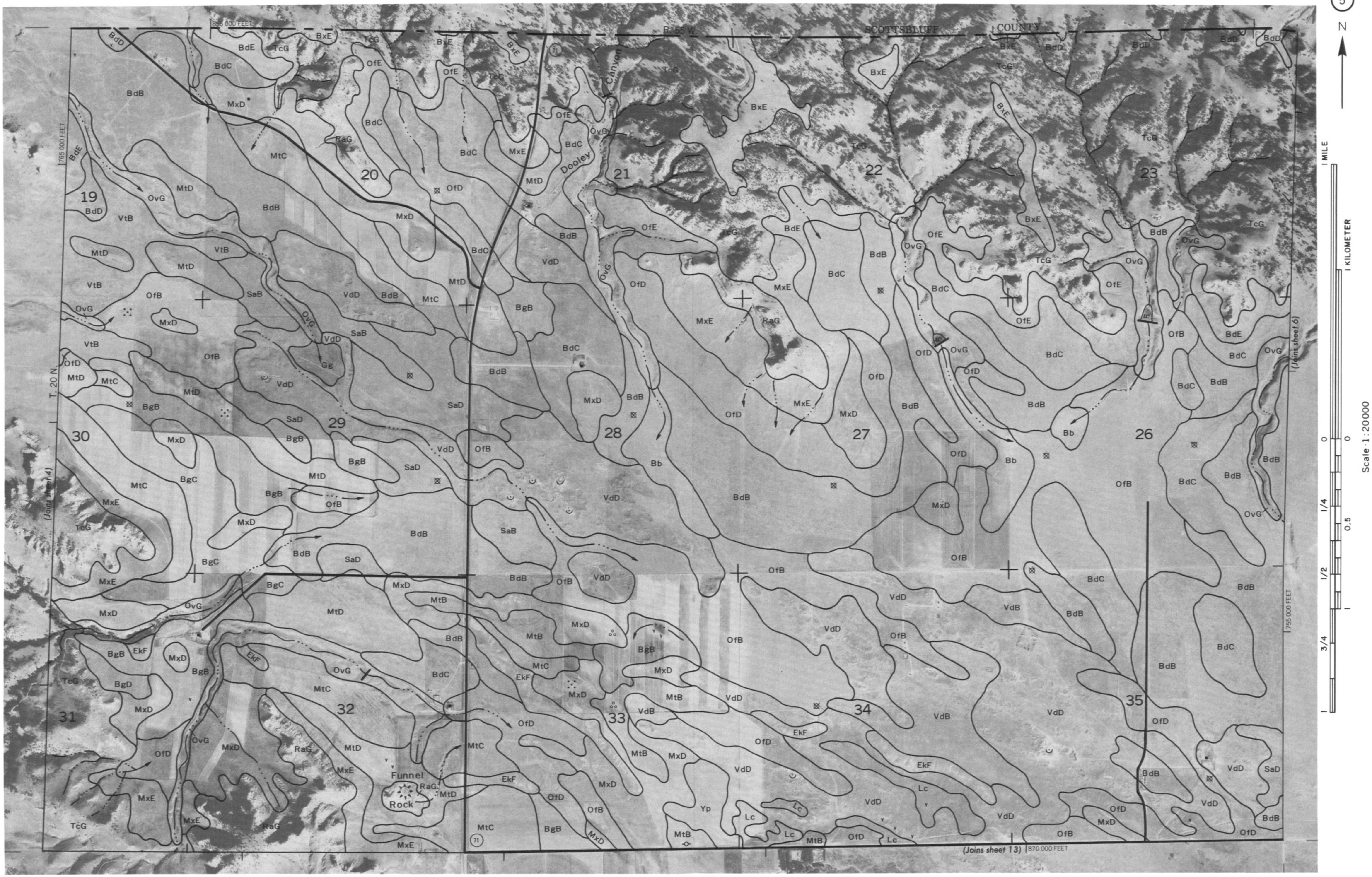
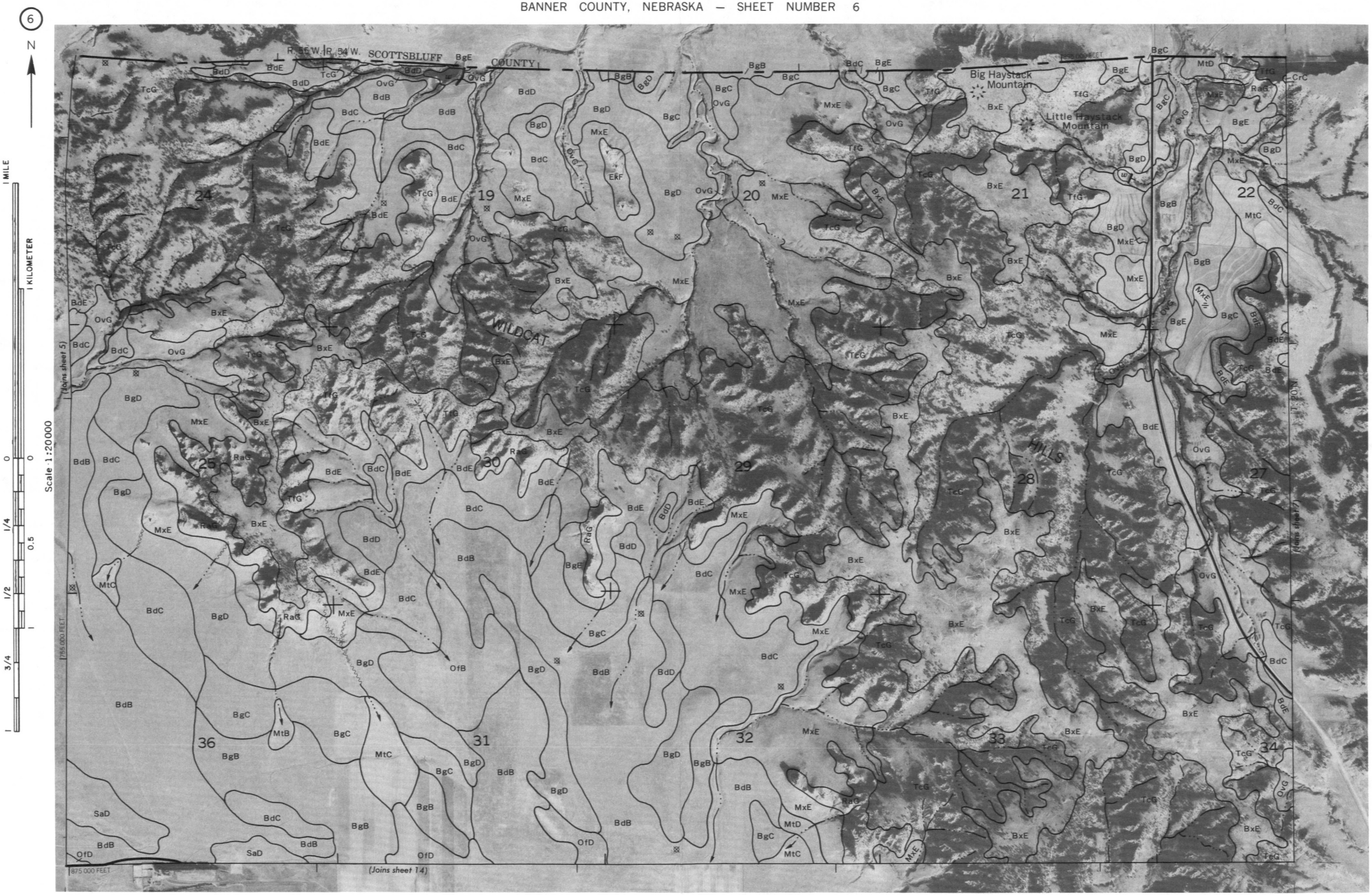
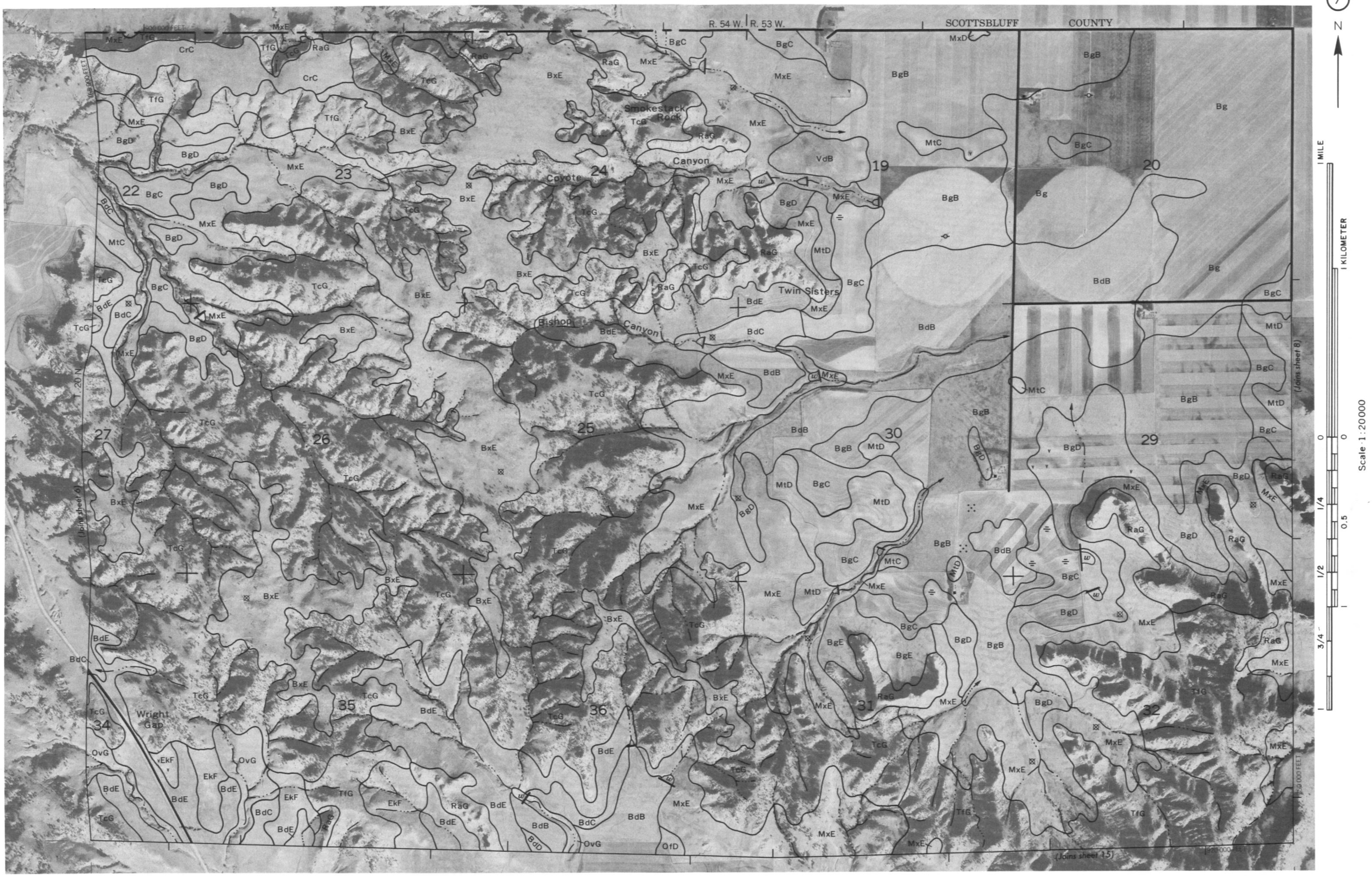
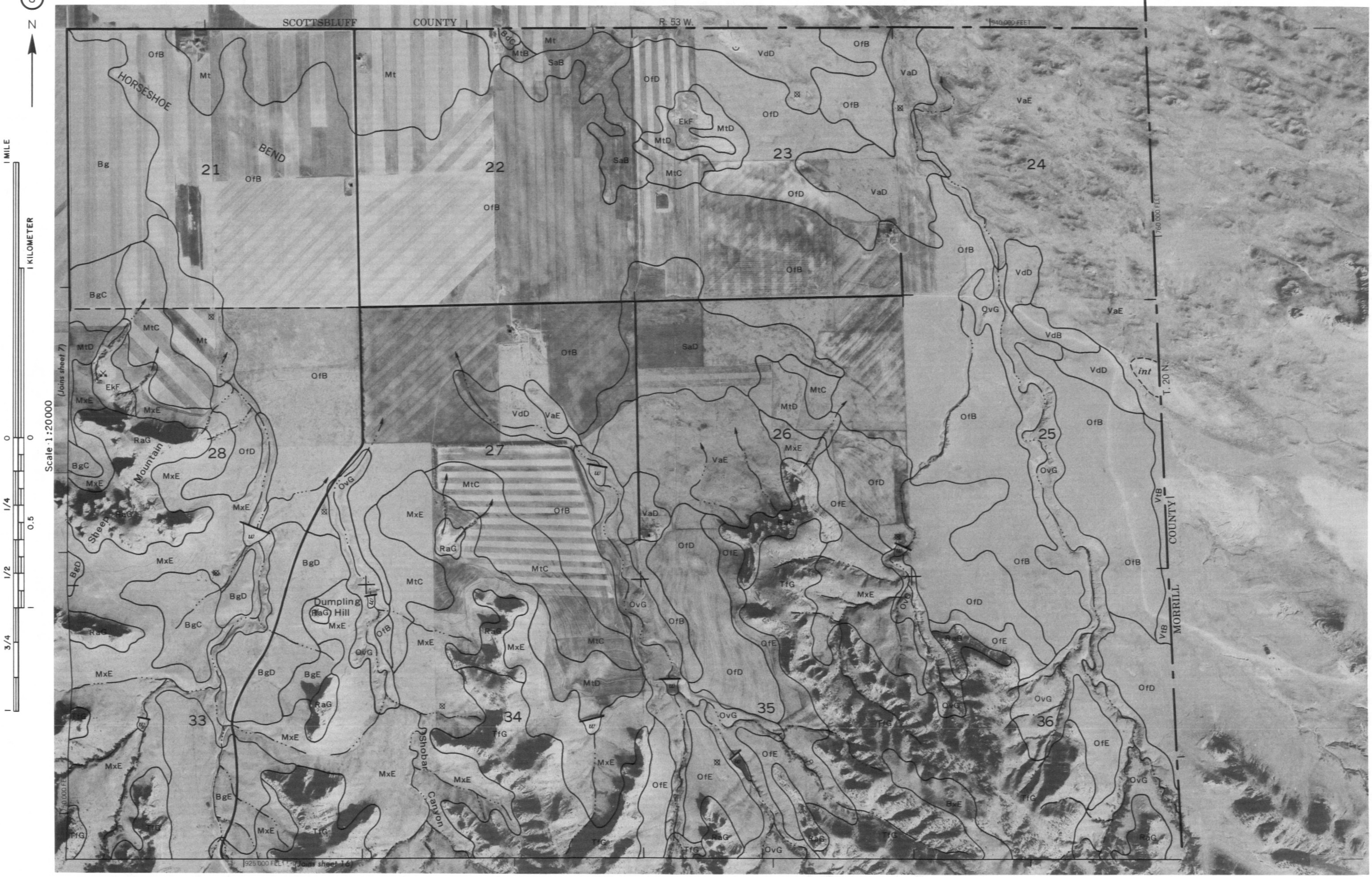
35
36
31
32
water
intermittent
int

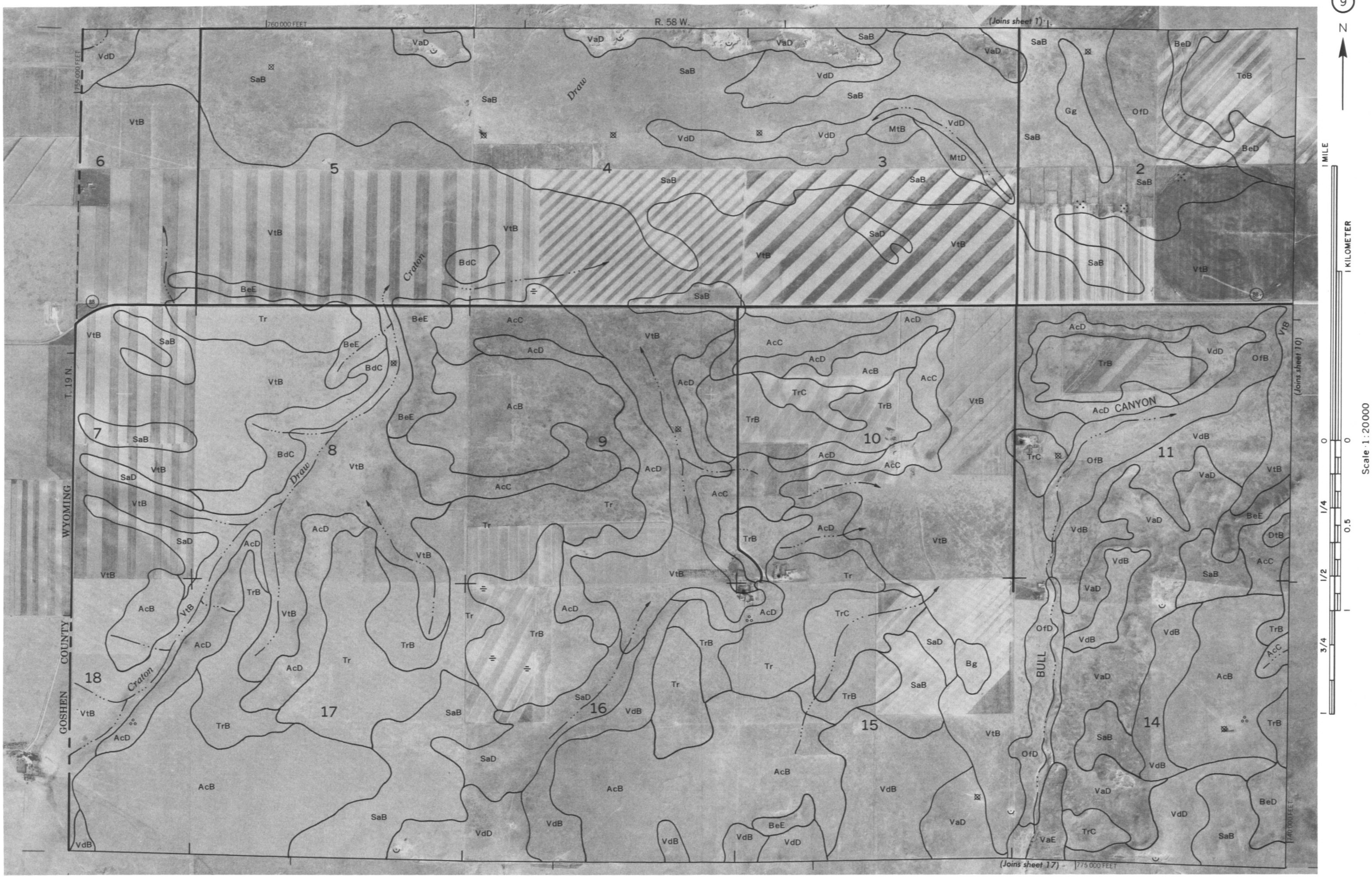

4
N
SCOTTSBLUFF
COUNTY
R. 56 W.
R. 55 W.
T. 20 N.
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 12)
HOGBACK MOUNTAIN
WILDCAT MOUNTAIN
Pumpkin
Creek
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
1
0
0.5
1
21
22
23
24
19
25
26
27
28
30
33
34
35
36
31


5
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
SCOTTSBLUFF COUNTY
R. 55 W.
T. 20 N.
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 13)
765 000 FEET
755 000 FEET
870 000 FEET
Dooley Canyon
Funnel Rock
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35


6
N
R. 55 W. R. 54 W.
SCOTTSBLUFF COUNTY
Big Haystack Mountain
Little Haystack Mountain
WILDCAT
HILLS
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 14)
875 000 FEET
Scale 1:20000
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
1
24
19
20
21
22
25
30
29
28
27
36
31
32
33
34
BdB
BdC
BdD
BdE
BgB
BgC
BgD
BgE
BxE
MxE
TcG
TfG
OvG
RaG
MtB
MtC
MtD
OfB
OfD
SaD
ExF
CrC

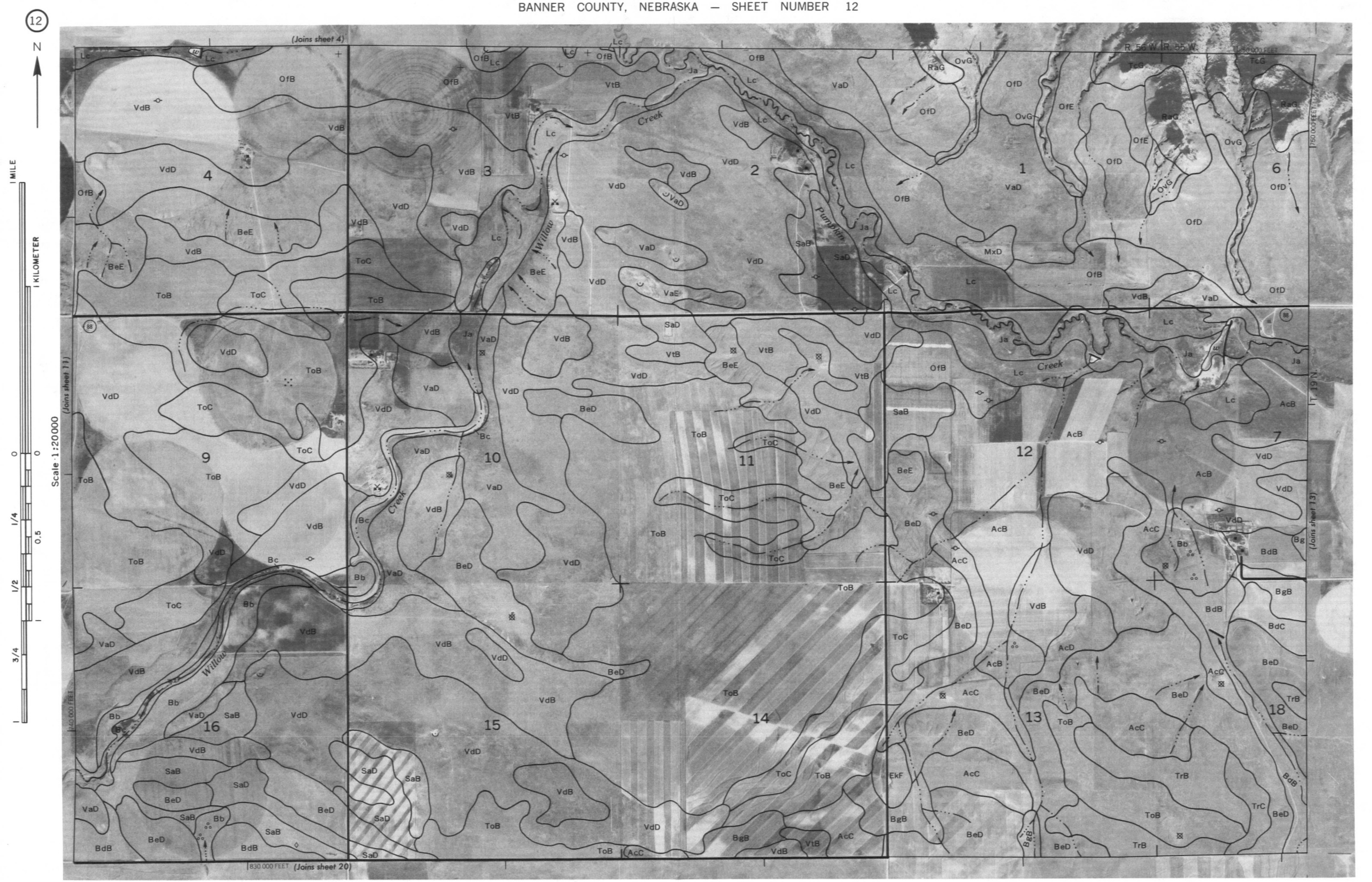

7
N
SCOTTSBLUFF COUNTY
R. 54 W. | R. 53 W.
Smokestack Rock
Coyote Canyon
Bishop Canyon
Twin Sisters
Wright Gap
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 8)
(Joins sheet 6)
(Joins sheet 15)
T. 20 N.

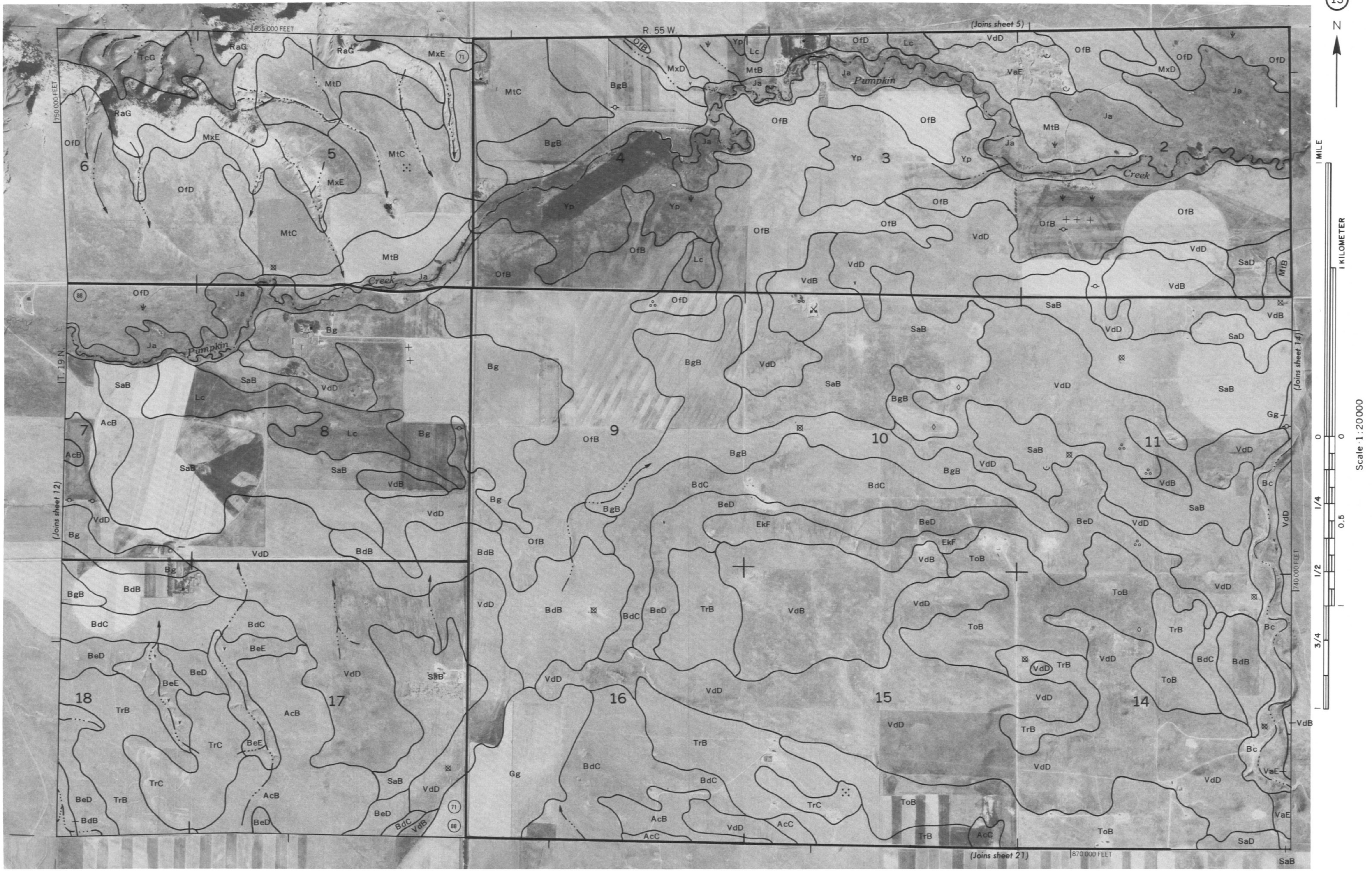

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
SCOTTSBLUFF COUNTY
R. 53 W.
T. 20 N.
MORRILL COUNTY
(Joins sheet 7)
(Joins sheet 16)
HORSESHOE BEND
Sheep Mountain
Dumpling Hill
Oshobar Canyon
21
22
23
24
25
26
27
28
33
34
35
36
OfB
Mt
Bg
BgC
MtC
MtD
EkF
MxE
RaG
BgD
BgE
OfD
OvG
MtB
SaB
BdC
VdD
VaD
VaE
VdB
VtB
SaD
OfE
TfG
BxE
int

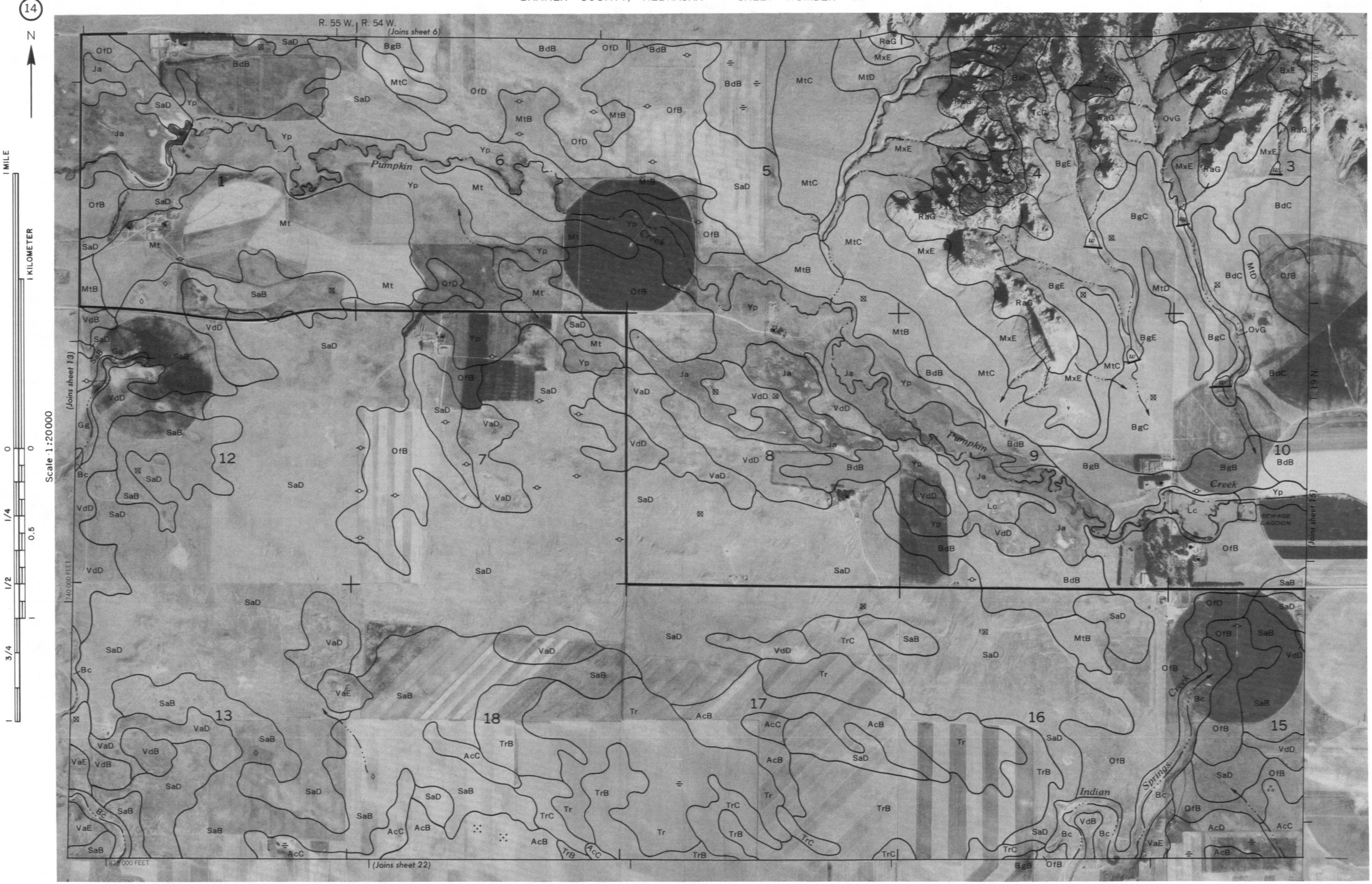

9
N
R. 58 W.
760 000 FEET
(Joins sheet 1)
(Joins sheet 10)
(Joins sheet 17)
775 000 FEET
T. 19 N.
WYOMING
GOSHEN COUNTY
Draw
Craton
Craton Draw
CANYON
BULL
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20000
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18
VdD
VaD
SaB
VtB
Gg
OfD
ToB
BeD
MtB
MtD
SaD
BdC
BeE
Tr
BdC
AcC
AcD
AcB
TrB
TrC
OfB
VdB
DtB
Bg
VaE
88

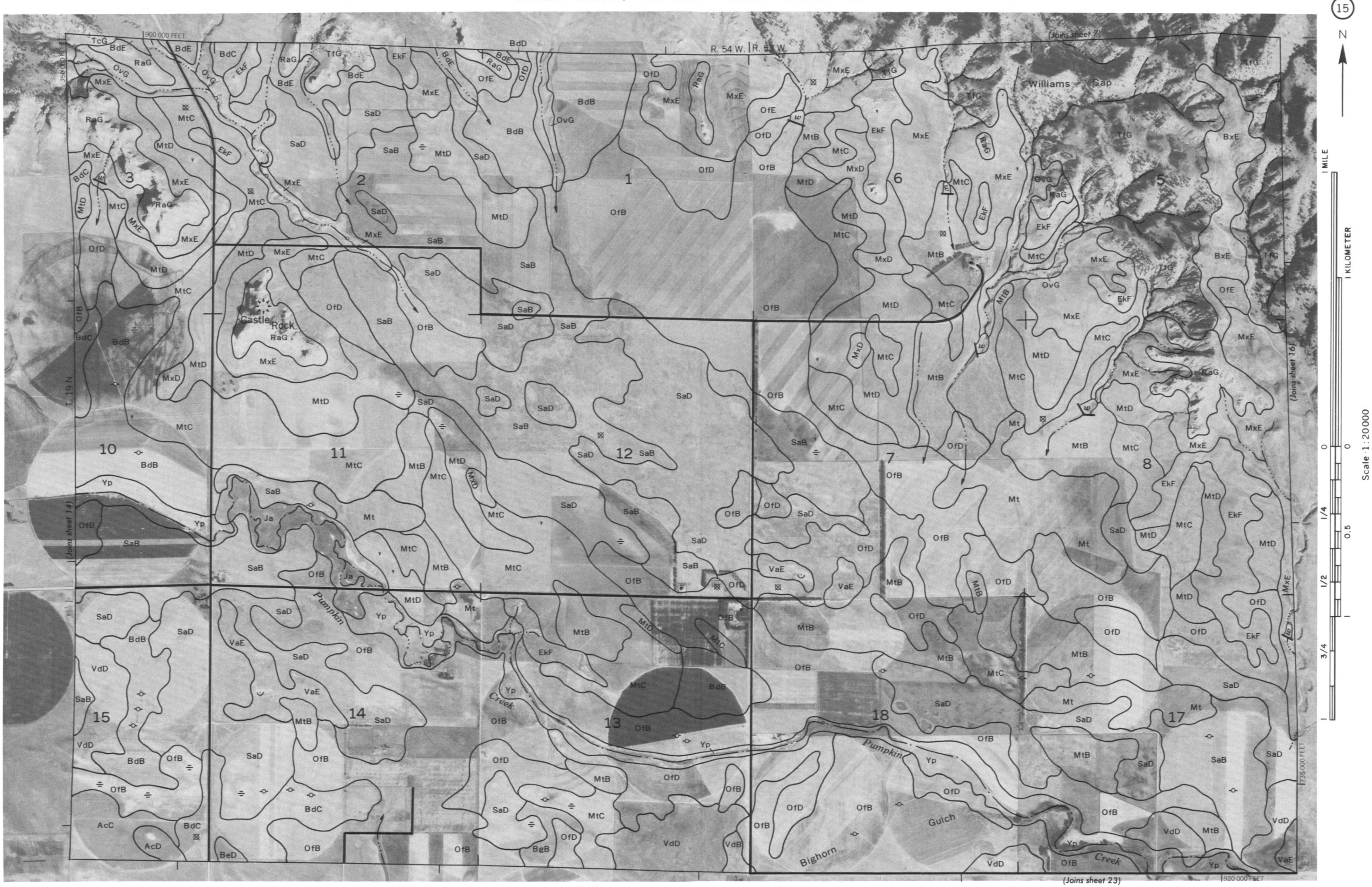

N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 2)
R. 58 W.
R. 57 W.
600 000 FEET
(Joins sheet 9)
(Joins sheet 11)
T. 19 N.
350 000 FEET
(Joins sheet 18)
780 000 FEET
340 000 FEET
BULL CANYON
CANYON
BULL
Draw
LONG CANYON
Clay Springs
1
2
3
4
5
6
7
8
9
10
12
13
15
16
17
18


11
N
(Joins sheet 3)
R. 57 W. R. 56 W.
BULL
CANYON
Draw
Springs
Clay
Willow
Creek
T. 19 N.
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 19)
805 000 FEET
825 000 FEET
750 000 FEET
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
1
0.5
VtB
BdC
BdD
AcC
VdD
ToB
BeD
BeE
SaB
SaD
OfB
OfD
VdB
Lc
MxD
EkF
VaD
ToC
TrB
TrC
TrD
AcB
Yp
Bc
BdB
1
2
3
5
6
7
8
10
11
12
13
14
15
17
18


12
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
(Joins sheet 4)
(Joins sheet 11)
(Joins sheet 13)
(Joins sheet 20)
R. 56 W. | R. 55 W.
T. 19 N.
830 000 FEET
Willow Creek
Pumpkin Creek
Creek
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18

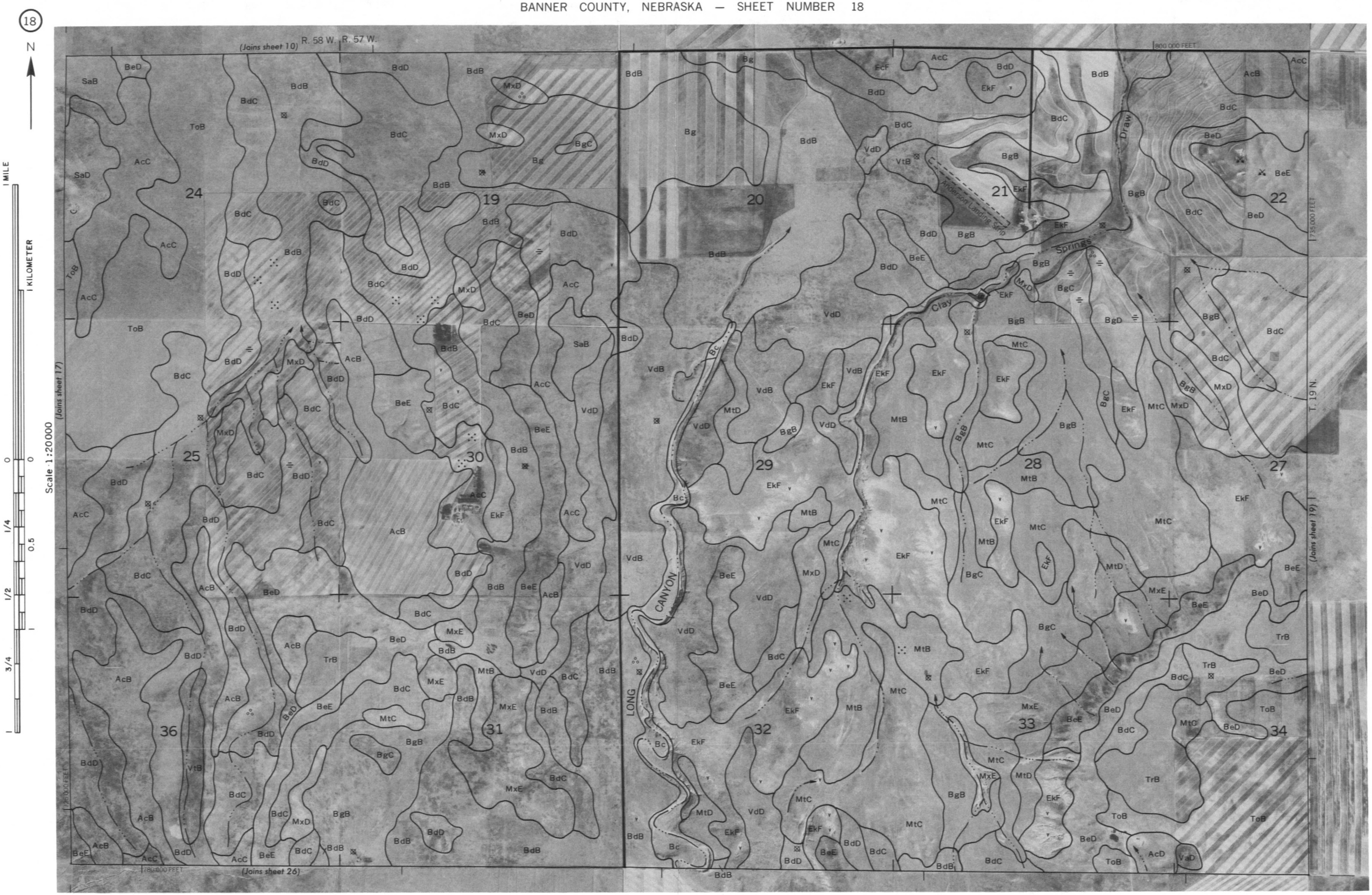

13
N
(Joins sheet 5)
R. 55 W.
855 000 FEET
750 000 FEET
T. 19 N.
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 21)
870 000 FEET
740 000 FEET
Pumpkin Creek
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
Scale 1:20000

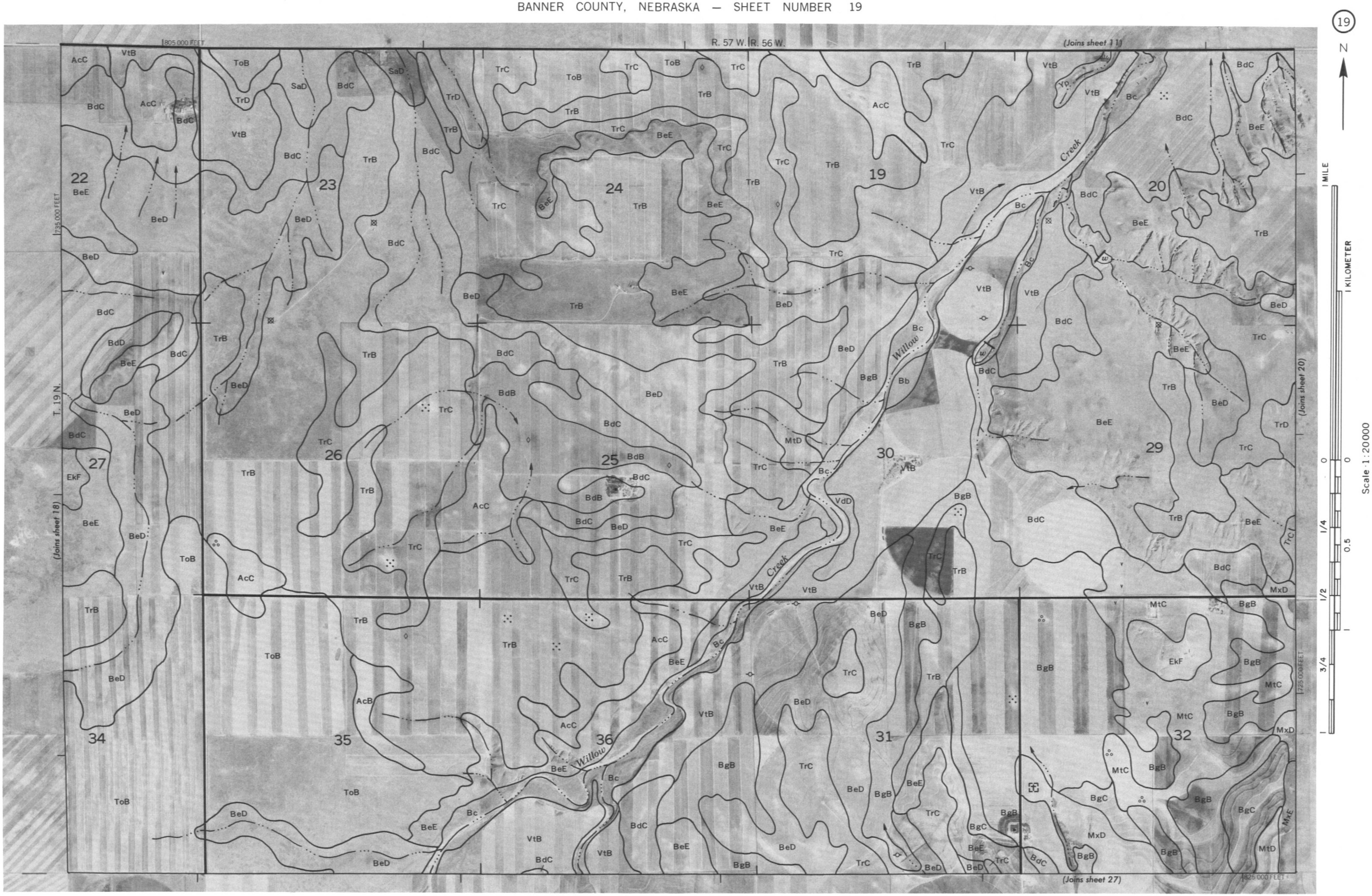

14
N
1 MILE
1 KILOMETER
Scale 1:20000
R. 55 W. R. 54 W.
(Joins sheet 6)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 22)
T. 19 N.
Pumpkin Creek
Indian Springs Creek
SEWAGE LAGOON


15
N
(Joins sheet 7)
R. 54 W.
R. 53 W.
900 000 FEET
750 000 FEET
T. 19 N.
Williams Gap
Castle Rock
Pumpkin Creek
Bighorn Gulch
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 23)
735 000 FEET
920 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5


16
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 8)
(Joins sheet 15)
(Joins sheet 24)
R. 53 W.
Hubbard Gap
Shobar Canyon
Logan Canyon
MORRILL COUNTY
940 000 FEET
735 000 FEET
925 000 FEET

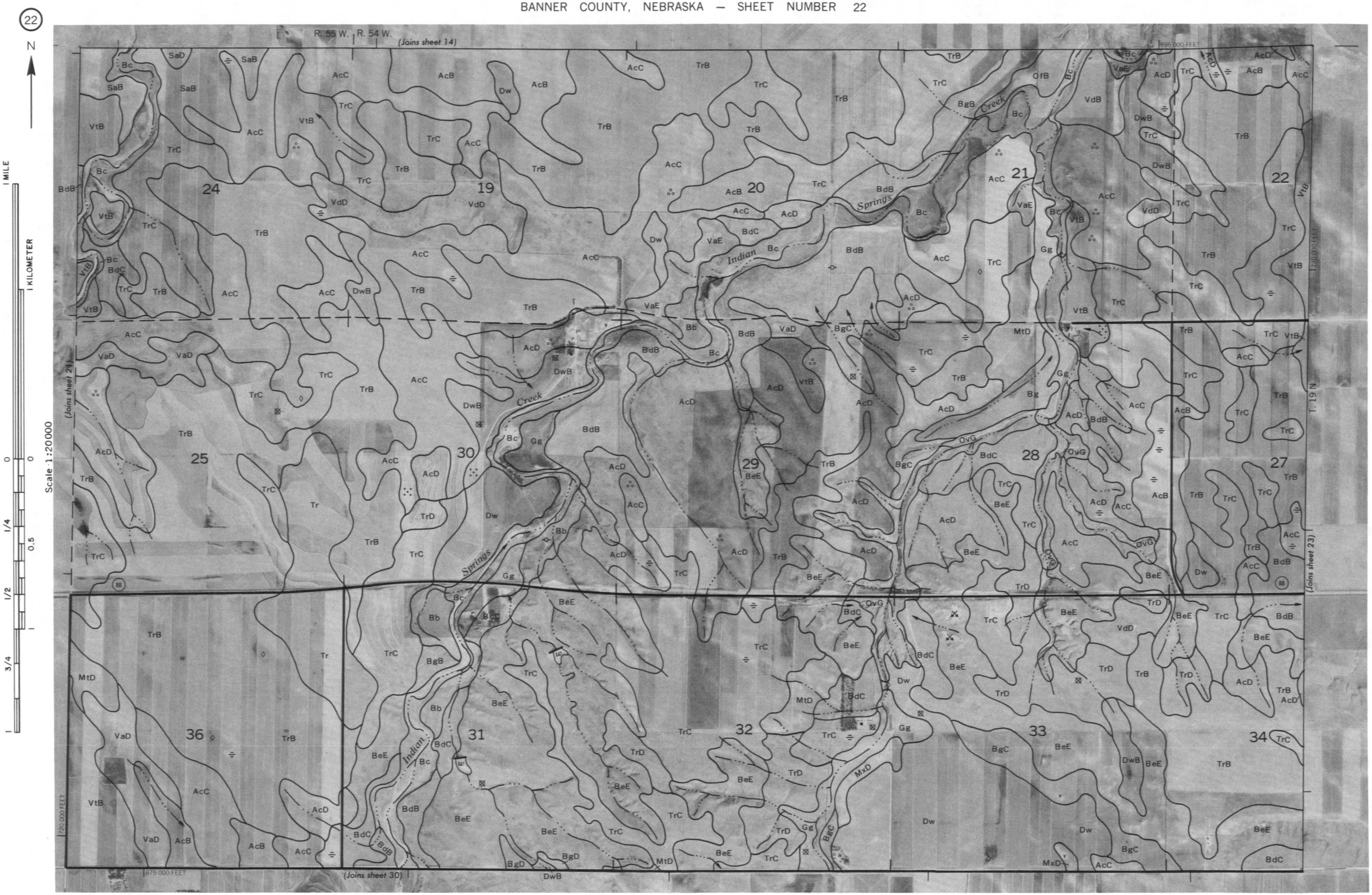

17
N
(Joins sheet 9)
(Joins sheet 18)
(Joins sheet 25)
760 000 FEET
740 000 FEET
725 000 FEET
775 000 FEET
R. 58 W.
T. 19 N.
GOSHEN COUNTY WYOMING
Bull Canyon
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5


18
N
(Joins sheet 10)
R. 58 W.
R. 57 W.
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 26)
T. 19 N.
Scale 1:20000
1 MILE
1 KILOMETER
Anderson Landing Strip
Clay Springs Draw
LONG CANYON


19
N
R. 57 W. R. 56 W.
(Joins sheet 11)
(Joins sheet 20)
(Joins sheet 27)
(Joins sheet 18)
T. 19 N.
805 000 FEET
825 000 FEET
735 000 FEET
725 000 FEET
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
Willow Creek
Willow Creek
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
AcC
VtB
BdC
BeE
BeD
ToB
SaD
TrD
TrB
TrC
SaD
BdD
EkF
AcB
Bc
Bb
BgB
BgC
MtD
MtC
MxD
MxE
VdD
BdB
Yp

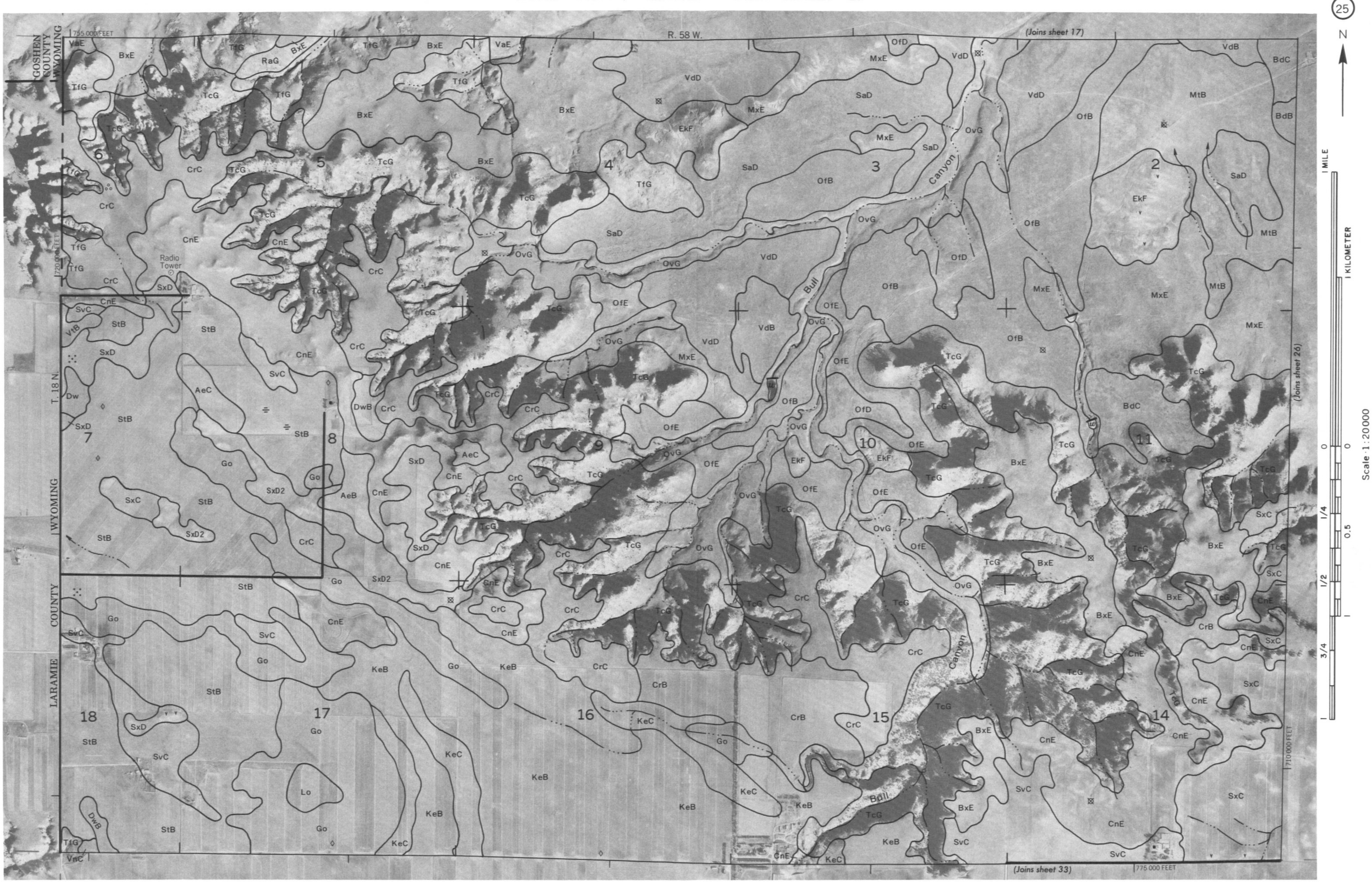

20
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 12)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 28)
R. 56 W. R. 55 W.
T. 19 N.
850 000 FEET
735 000 FEET
725 000 FEET
830 000 FEET
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
S-4A


21
N
R. 55 W.
(Joins sheet 13)
(Joins sheet 29)
(Joins sheet 20)
(Joins sheet 22)
T. 19 N.
855 000 FEET
235 000 FEET
870 000 FEET
220 000 FEET
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
1
0.5

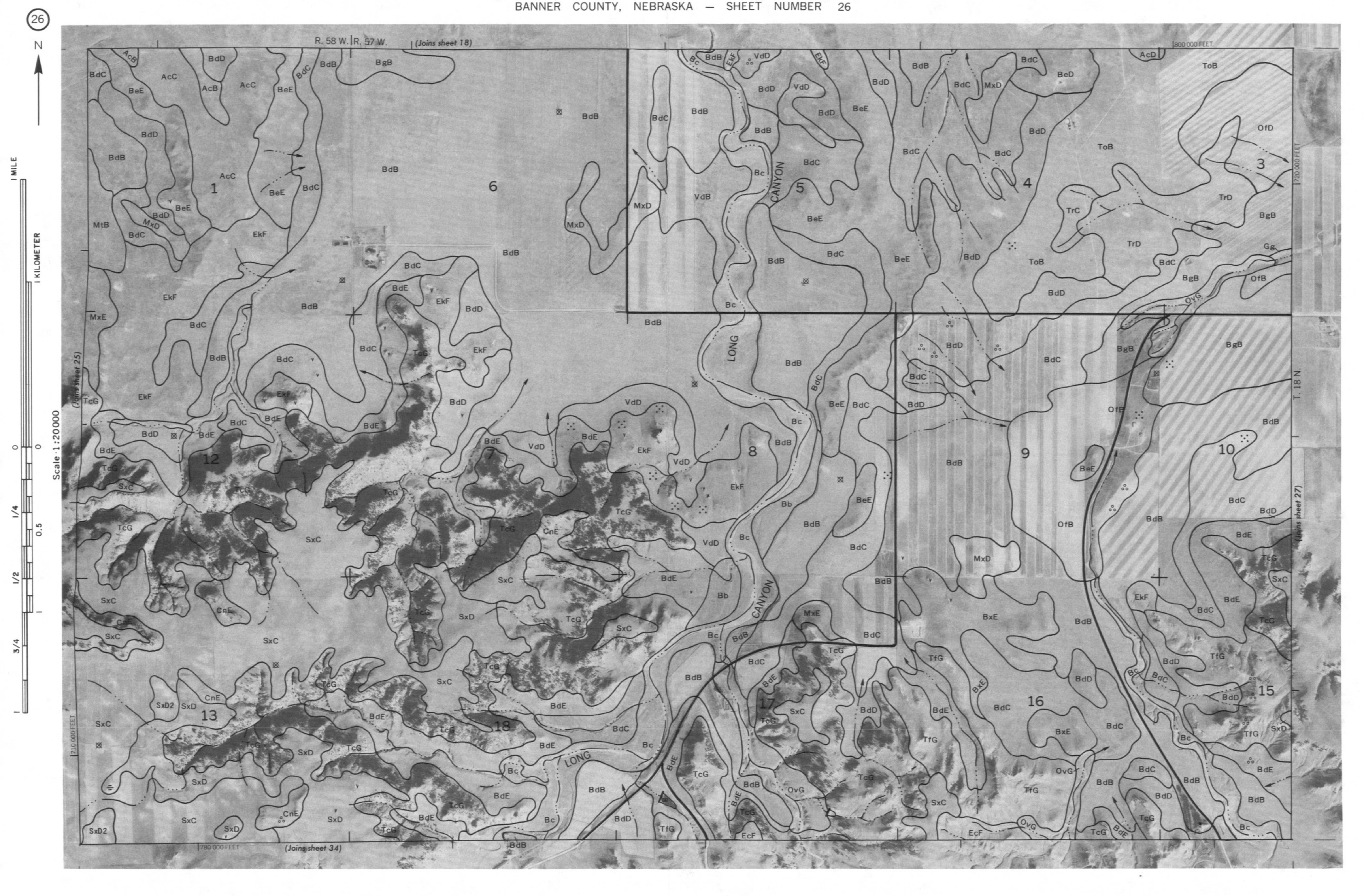

22
N
1 MILE
1 KILOMETER
Scale 1:20000
R. 55 W.
R. 54 W.
(Joins sheet 14)
(Joins sheet 21)
(Joins sheet 23)
(Joins sheet 30)
T. 19 N.
Indian
Springs
Creek
895 000 FEET
875 000 FEET
720 000 FEET
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36


23
N
(Joins sheet 15)
(Joins sheet 24)
(Joins sheet 31)
(Joins sheet 22)
R. 54 W. R. 53 W.
T. 19 N.
900 000 FEET
730 000 FEET
720 000 FEET
920 000 FEET
Pumpkin Creek
Bighorn Gulch
Wright Community Hall
water
1 MILE
1 KILOMETER
Scale 1:20000


24
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 16)
(Joins sheet 23)
(Joins sheet 32)
R. 53 W.
T. 19 N.
MORRILL COUNTY
940 000 FEET
730 000 FEET
720 000 FEET
925 000 FEET
Pumpkin Creek
Hackberry Creek
Chalk Creek
21
22
23
24
25
26
27
28
33
34
35
36



25
N
R. 58 W.
(Joins sheet 17)
(Joins sheet 26)
(Joins sheet 33)
GOSHEN COUNTY WYOMING
LARAMIE COUNTY WYOMING
T. 18 N.
755 000 FEET
720 000 FEET
710 000 FEET
775 000 FEET
Radio Tower
Bull Canyon
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5
VaE
BxE
TfG
RaG
TcG
CrC
CnE
SxD
SvC
StB
VtB
Dw
AeC
Go
SxD2
CrC
DwB
AeB
VdD
EkF
MxE
SaD
OfD
OfB
OvG
OfE
VdB
MtB
BdC
BdB
CrB
KeB
KeC
Lo
SxC
VnC

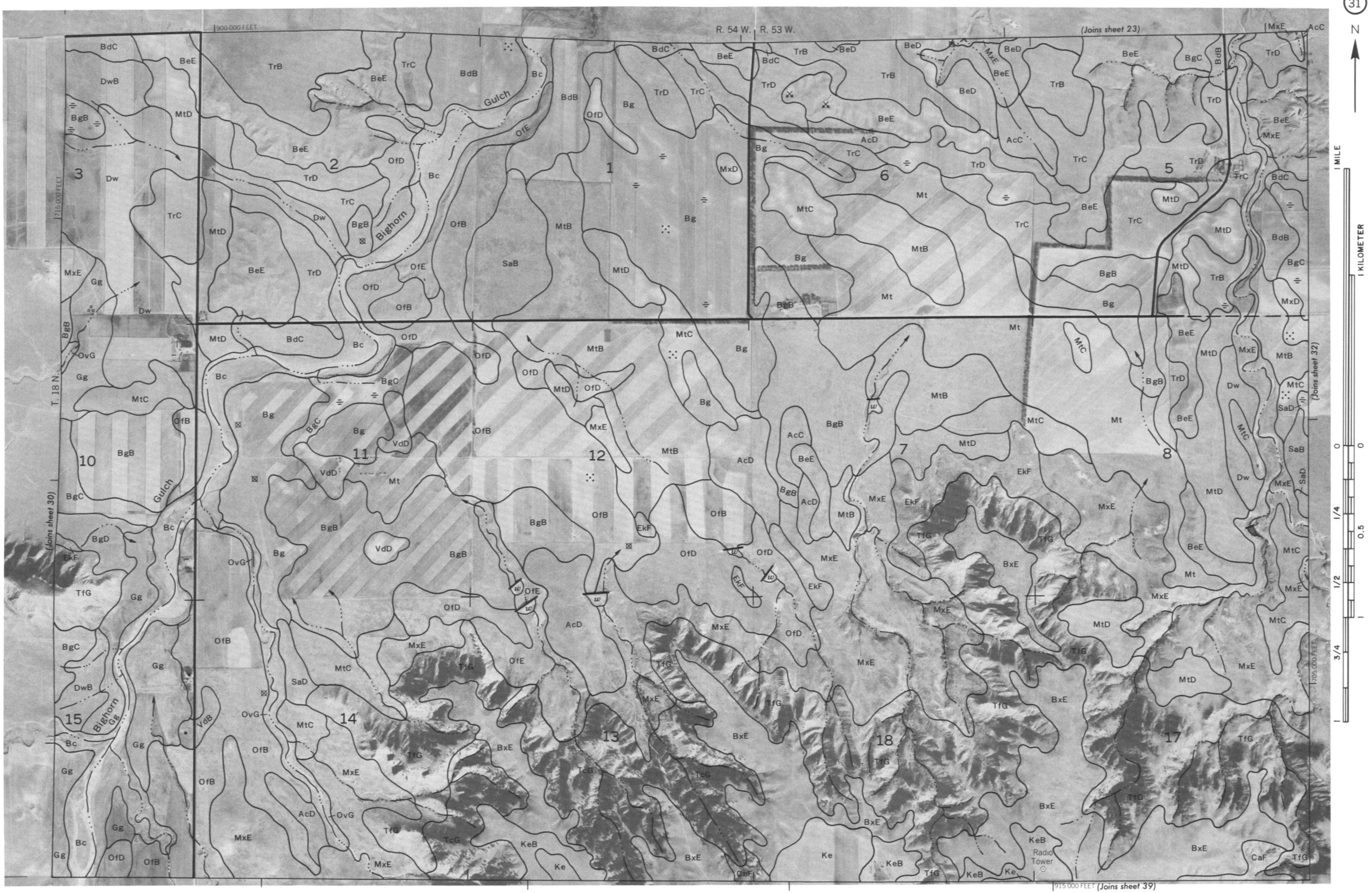

26
N
1 MILE
1 KILOMETER
Scale 1:20000
R. 58 W. | R. 57 W.
(Joins sheet 18)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 34)
T. 18 N.
800 000 FEET
720 000 FEET
780 000 FEET
210 000 FEET
LONG CANYON
LONG CANYON
LONG


R. 57 W. R. 56 W.
(Joins sheet 19)
(Joins sheet 28)
(Joins sheet 35)
(Joins sheet 26)
805 000 FEET
720 000 FEET
710 000 FEET
825 000 FEET
T. 18 N.
GABE ROCK CEMETERY
Gabe Rock
Willow Creek
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5

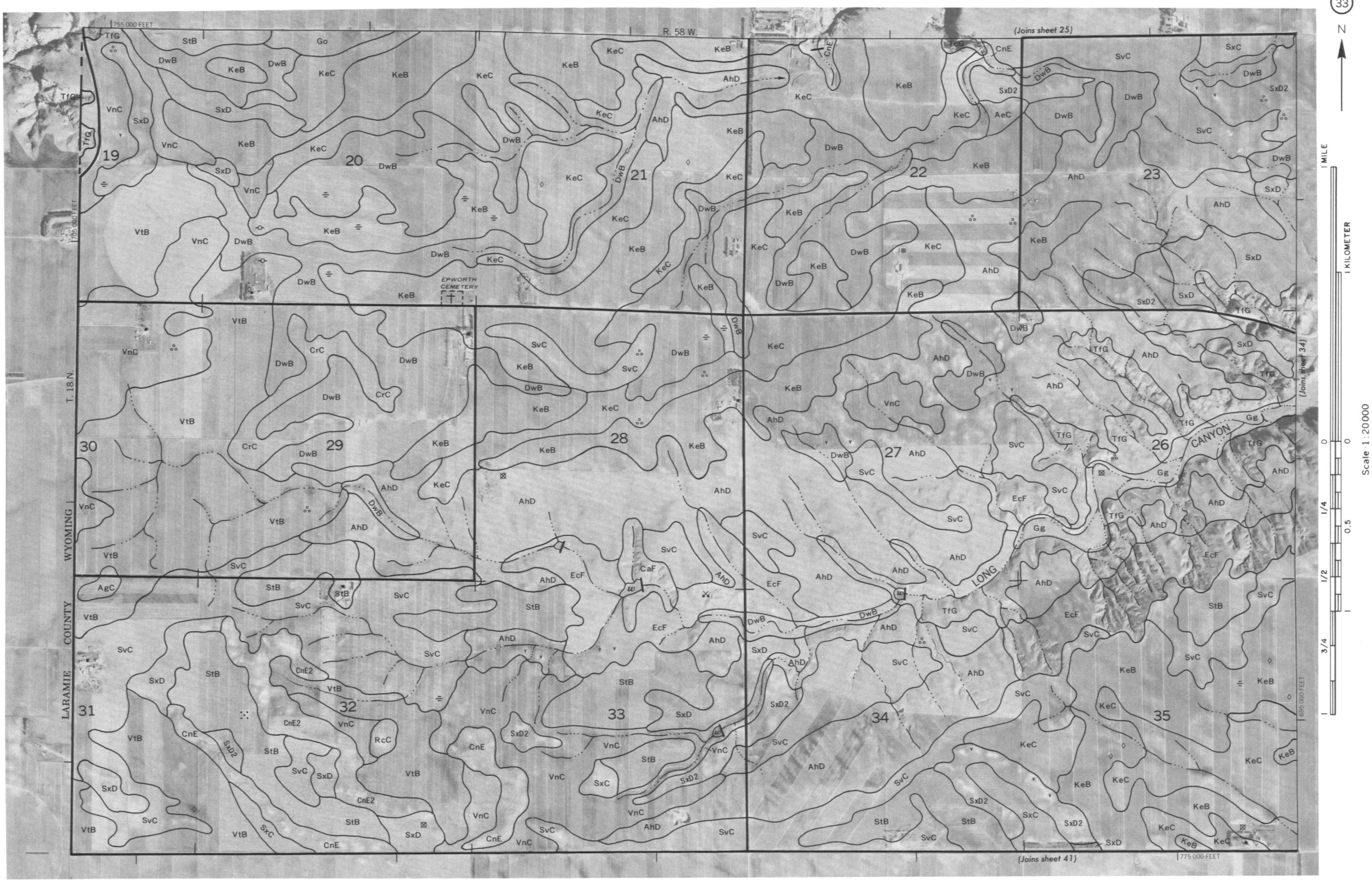

28
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 20)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 36)
845 000 FEET
830 000 FEET
710 000 FEET
720 000 FEET
R. 56 W.
R. 55 W.
T. 18 N.
Harrisburg
(county seat)
HARRISBURG
CEMETERY
S4A
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
Bg
BgB
BgC
BgD
BdB
BdC
BdD
BeE
Bc
MtC
MtD
MtB
MxD
MxE
EkF
EcF
TrB
TrC
TrD
TcG
TfG
SxC
OfB
RaG
AhD
Gg

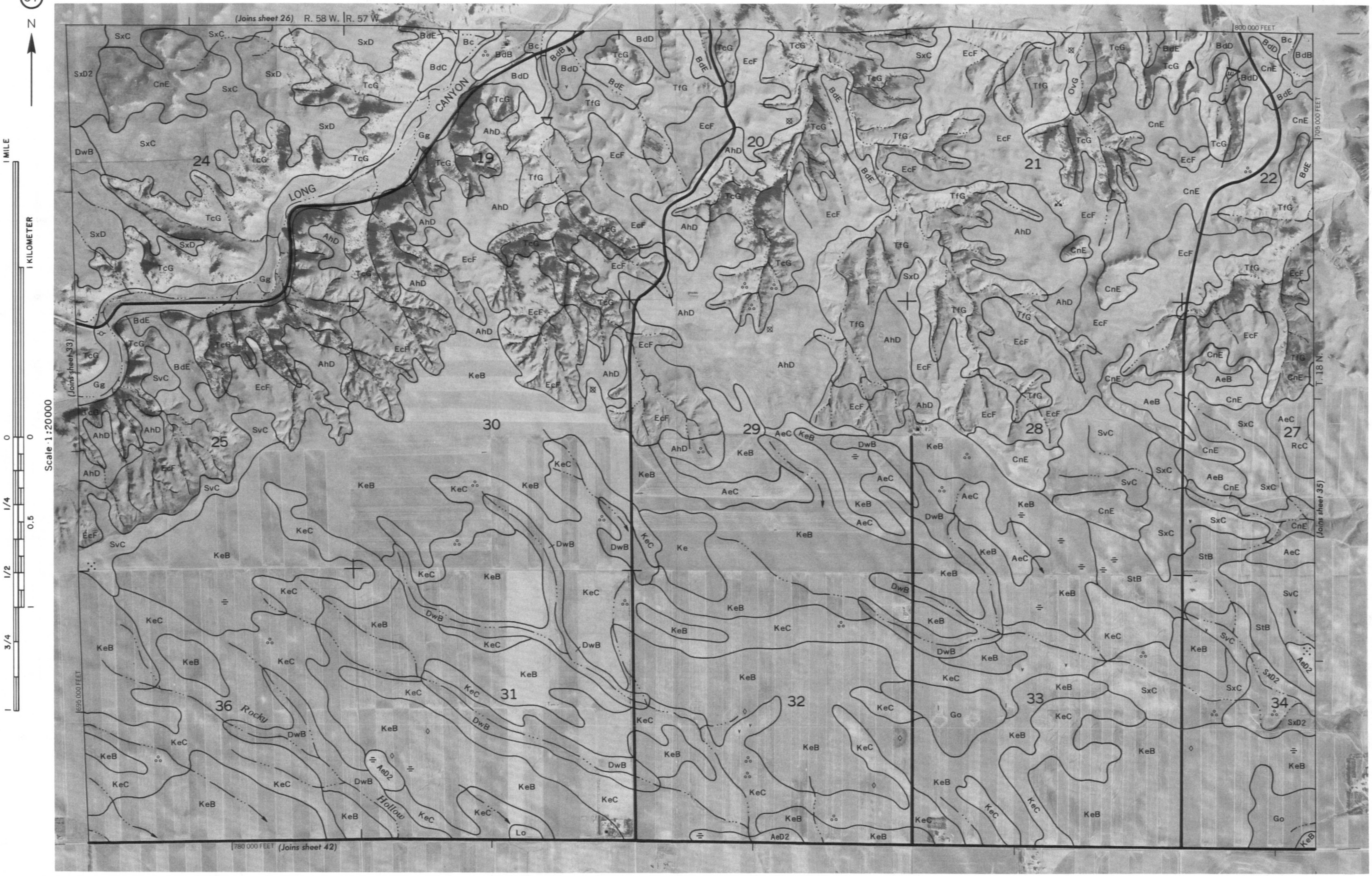

29
N
(Joins sheet 21)
R. 55 W.
850 000 FEET
720 000 FEET
T. 18 N.
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 37)
870 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5
Indian Springs Creek
water
1
2
3
4
5
6
7
8
9
10
11
14
15
16
17
18

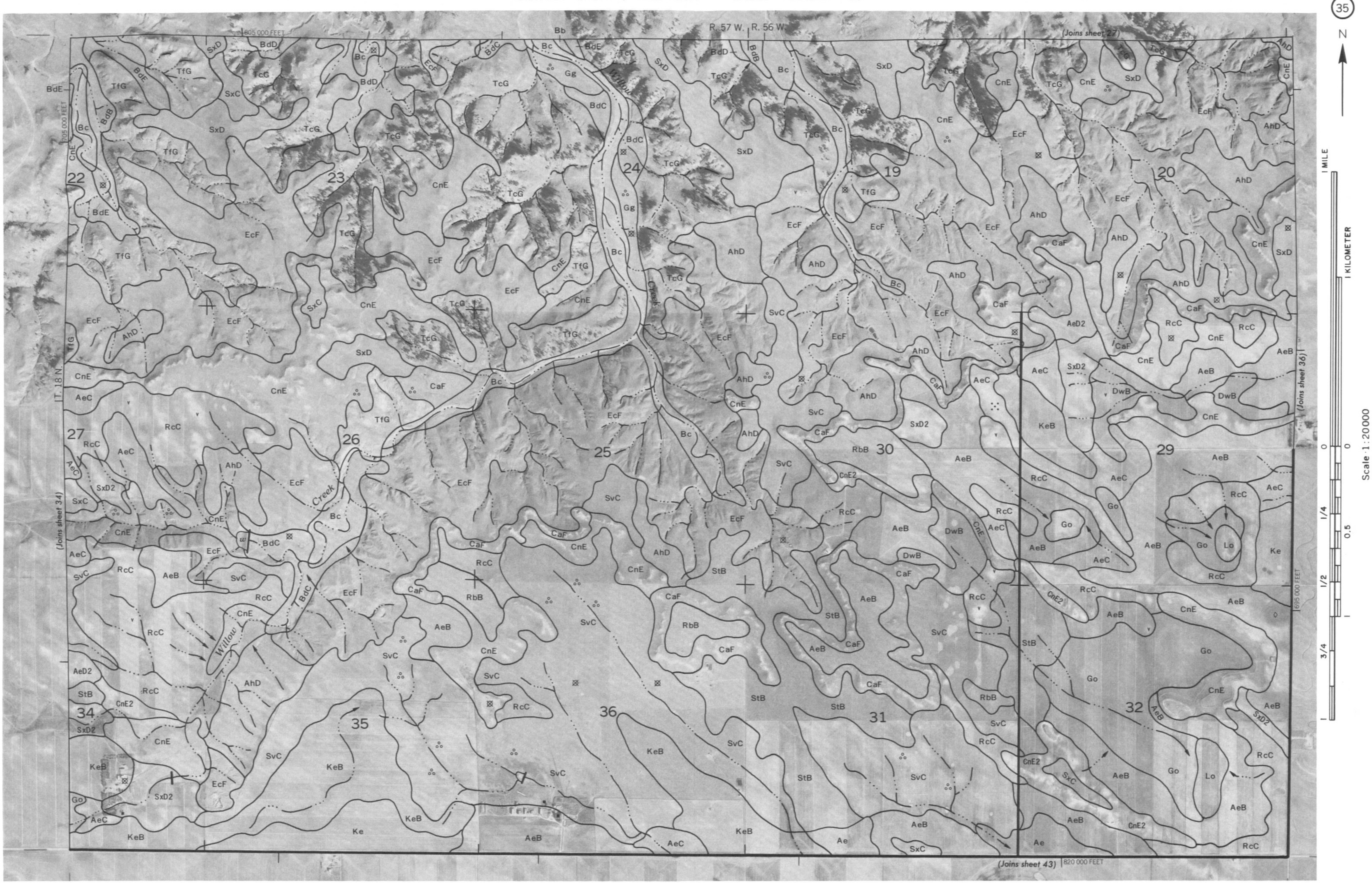

30
N
R. 55 W. R. 54 W.
(Joins sheet 22)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 38)
T. 18 N.
895 000 FEET
375 000 FEET
Scale 1:20000
1 MILE
1 KILOMETER
Table Top Mountain
Indian Springs Creek
Canyon Springs
Indian Springs
Bighorn Mountain

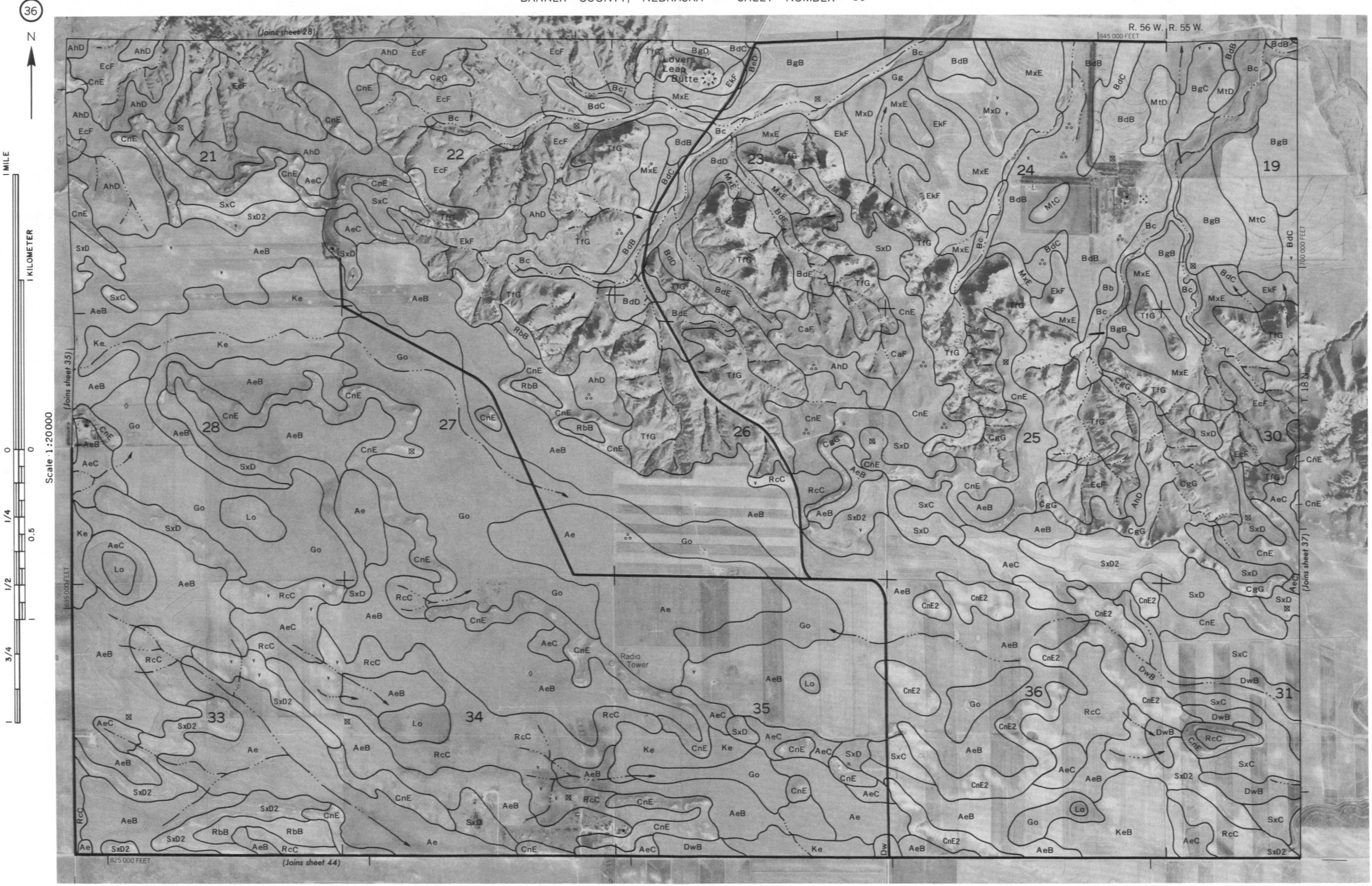

31
N
(Joins sheet 23)
900 000 FEET
R. 54 W.
R. 53 W.
T. 18 N.
715 000 FEET
705 000 FEET
(Joins sheet 30)
(Joins sheet 32)
915 000 FEET
(Joins sheet 39)
Bighorn
Gulch
Radio Tower
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20 000

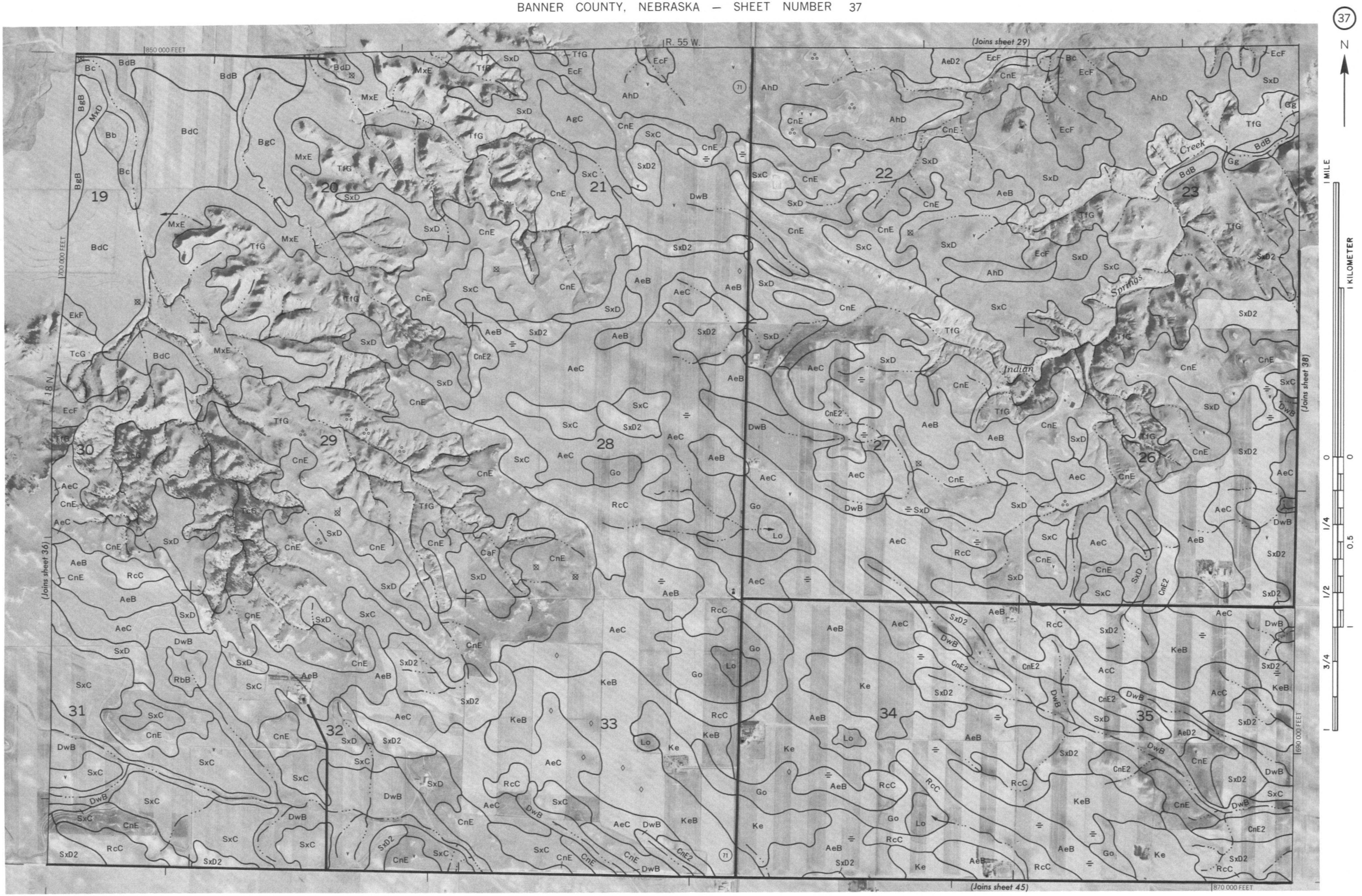

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 24)
(Joins sheet 31)
(Joins sheet 40)
R. 53 W.
T. 18 N.
940 000 FEET
715 000 FEET
705 000 FEET
920 000 FEET
Creek
Hackberry
CHALK CREEK CEMETERY
Chalk Mound
MORRILL COUNTY
1
2
3
4
9
10
11
12
13
14
15
16


33
N
R. 58 W.
(Joins sheet 25)
(Joins sheet 34)
(Joins sheet 41)
755 000 FEET
765 000 FEET
775 000 FEET
695 000 FEET
T. 18 N.
WYOMING
LARAMIE COUNTY
EPWORTH CEMETERY
LONG
CANYON
19
20
21
22
23
30
29
28
27
26
31
32
33
34
35
1 MILE
1 KILOMETER
Scale 1:20000


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 26)
R. 58 W.
R. 57 W.
800 000 FEET
705 000 FEET
T. 18 N.
(Joins sheet 33)
(Joins sheet 35)
695 000 FEET
780 000 FEET
(Joins sheet 42)
LONG
CANYON
Rocky
Hollow
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
SxC
SxD
SxD2
CnE
TcG
BdE
Bc
BdB
BdC
BdD
TfG
EcF
Gg
DwB
AhD
OvG
SvC
KeB
KeC
Ke
AeC
AeB
AeD2
StB
RcC
Go
Lo


35
N
R. 57 W.
R. 56 W.
(Joins sheet 27)
(Joins sheet 36)
(Joins sheet 43)
(Joins sheet 34)
T. 18 N.
805 000 FEET
820 000 FEET
705 000 FEET
695 000 FEET
Willow
Creek
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20000
Ae
AeB
AeC
AeD2
AhD
Bb
Bc
BdB
BdC
BdD
BdE
CaF
CnE
CnE2
DwB
EcF
Gg
Go
Ke
KeB
Lo
RbB
RcC
StB
SvC
SxC
SxD
SxD2
TcG
TfG


36
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 28)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 44)
R. 56 W.
R. 55 W.
T. 18 N.
845 000 FEET
700 000 FEET
695 000 FEET
825 000 FEET
Lovers Leap Butte
Radio Tower
19
21
22
23
24
25
26
27
28
30
31
33
34
35
36

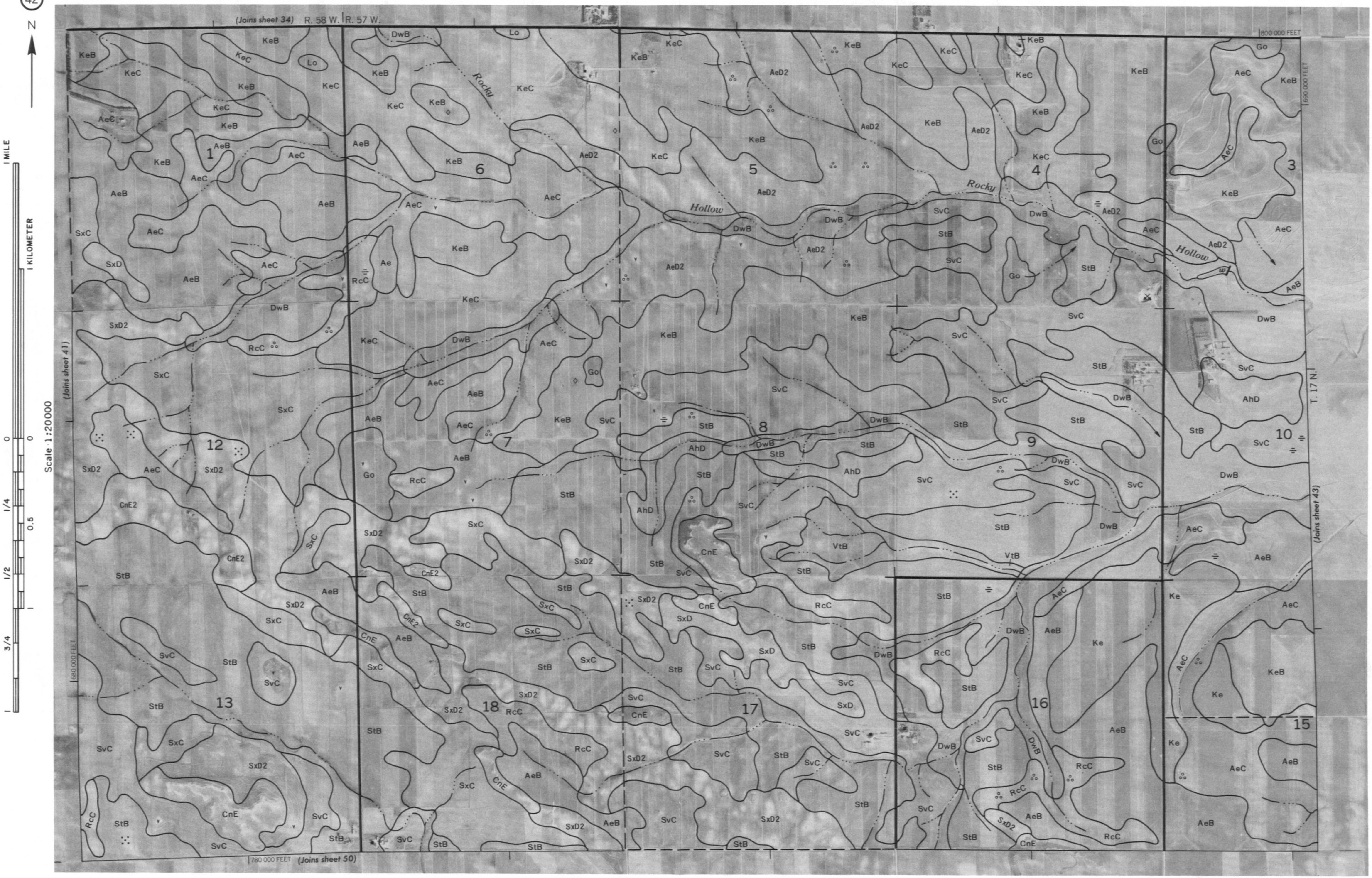

37
N
(Joins sheet 29)
(Joins sheet 38)
(Joins sheet 45)
(Joins sheet 36)
R. 55 W.
T. 18 N.
850 000 FEET
700 000 FEET
690 000 FEET
870 000 FEET
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20 000
Indian Springs Creek
71
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
Bc
BdB
BdD
BgB
MxD
Bb
BdC
BgC
MxE
TfG
TfB
SxD
EcF
AhD
AgC
CnE
SxC
SxD2
DwB
AeD2
Gg
EkF
TcG
CnE2
AeB
AeC
Go
RcC
Lo
CaF
RbB
KeB
Ke
AcC
AeD2
CnE2

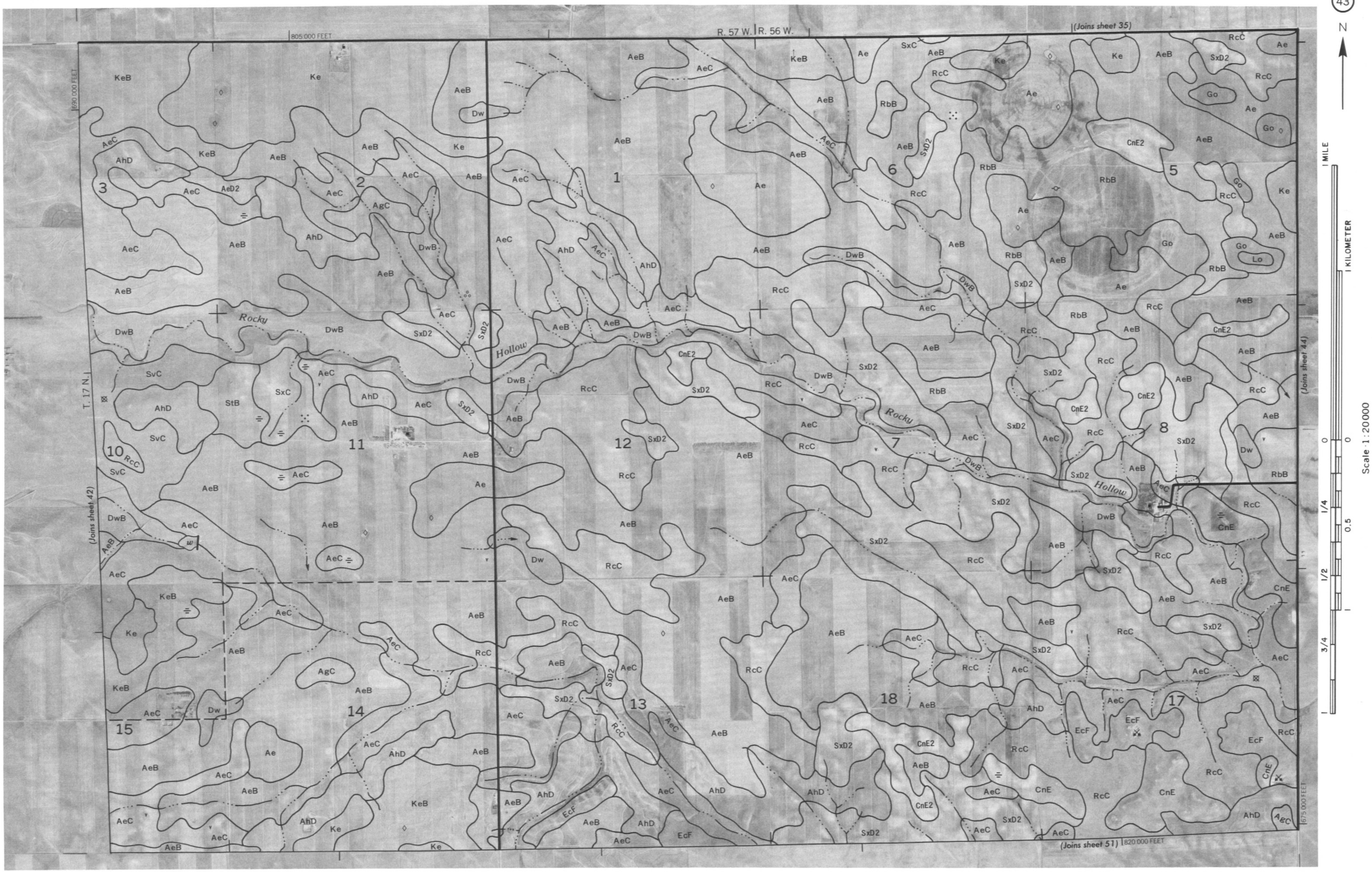

38
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
R. 55 W. | R. 54 W. (Joins sheet 30)
895 000 FEET
700 000 FEET
T. 18 N.
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 46)
690 000 FEET
875 000 FEET
Indian
Springs Creek
Bighorn
Gulch
Lawrence
Fork
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
SxD
Gg
RaG
TfG
Bc
SxD2
KeB
DwB
SvC
CnE
KeC
CaF
AhD
AeB
TcG
KeB
RcC
Ke
AeC
EcF
SxC
EkF
MxE
BdD
BdE
BdC
BdB
Bb
AeB
CnE2
RbB

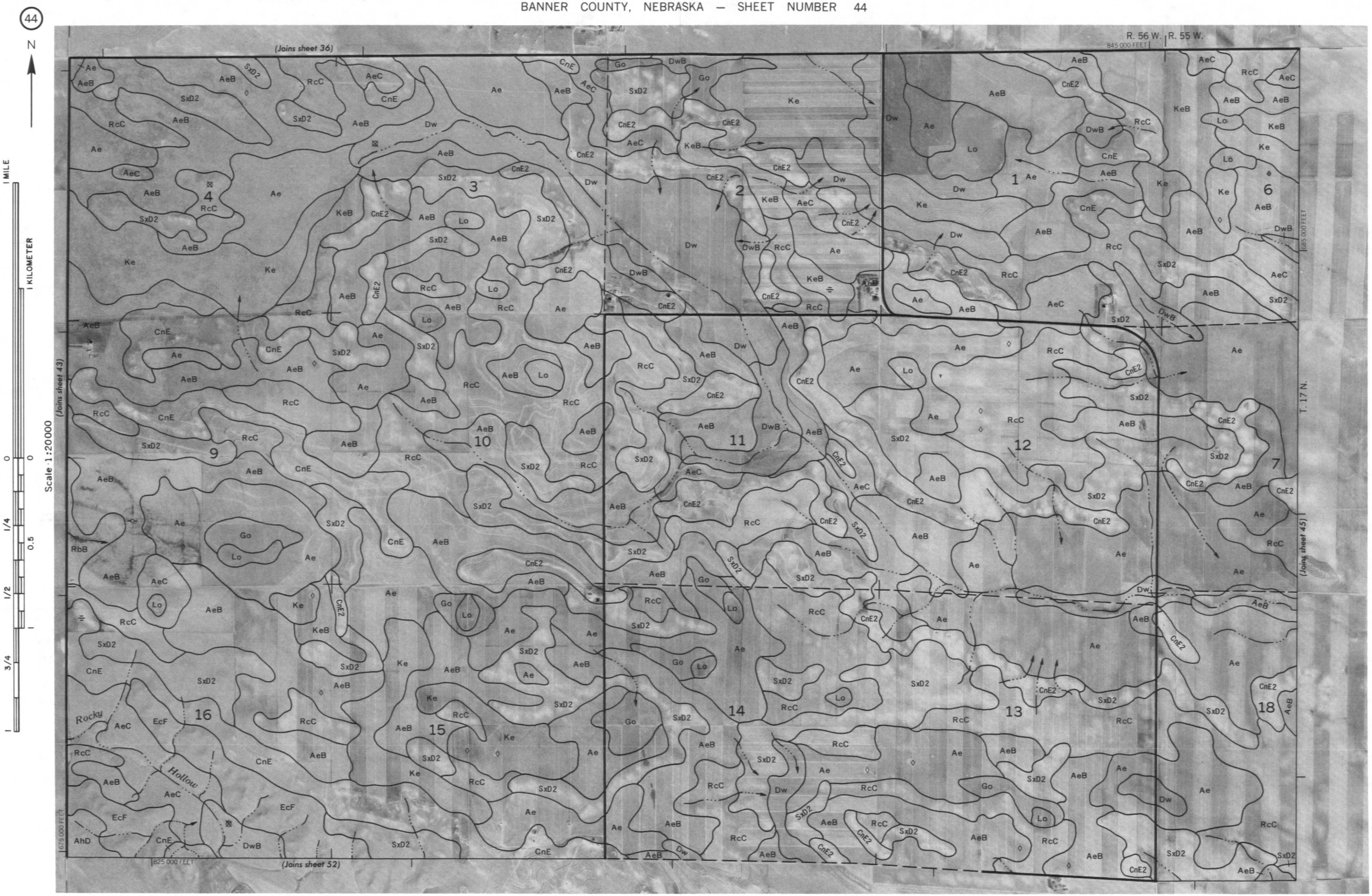

39
N
(Joins sheet 31)
(Joins sheet 40)
(Joins sheet 47)
(Joins sheet 38)
R. 54 W. | R. 53 W.
T. 18 N.
900 000 FEET
700 000 FEET
690 000 FEET
915 000 FEET
Bighorn Gulch
KIRK CEMETERY
22
23
24
19
20
27
26
25
30
29
34
35
36
31
32
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:20000

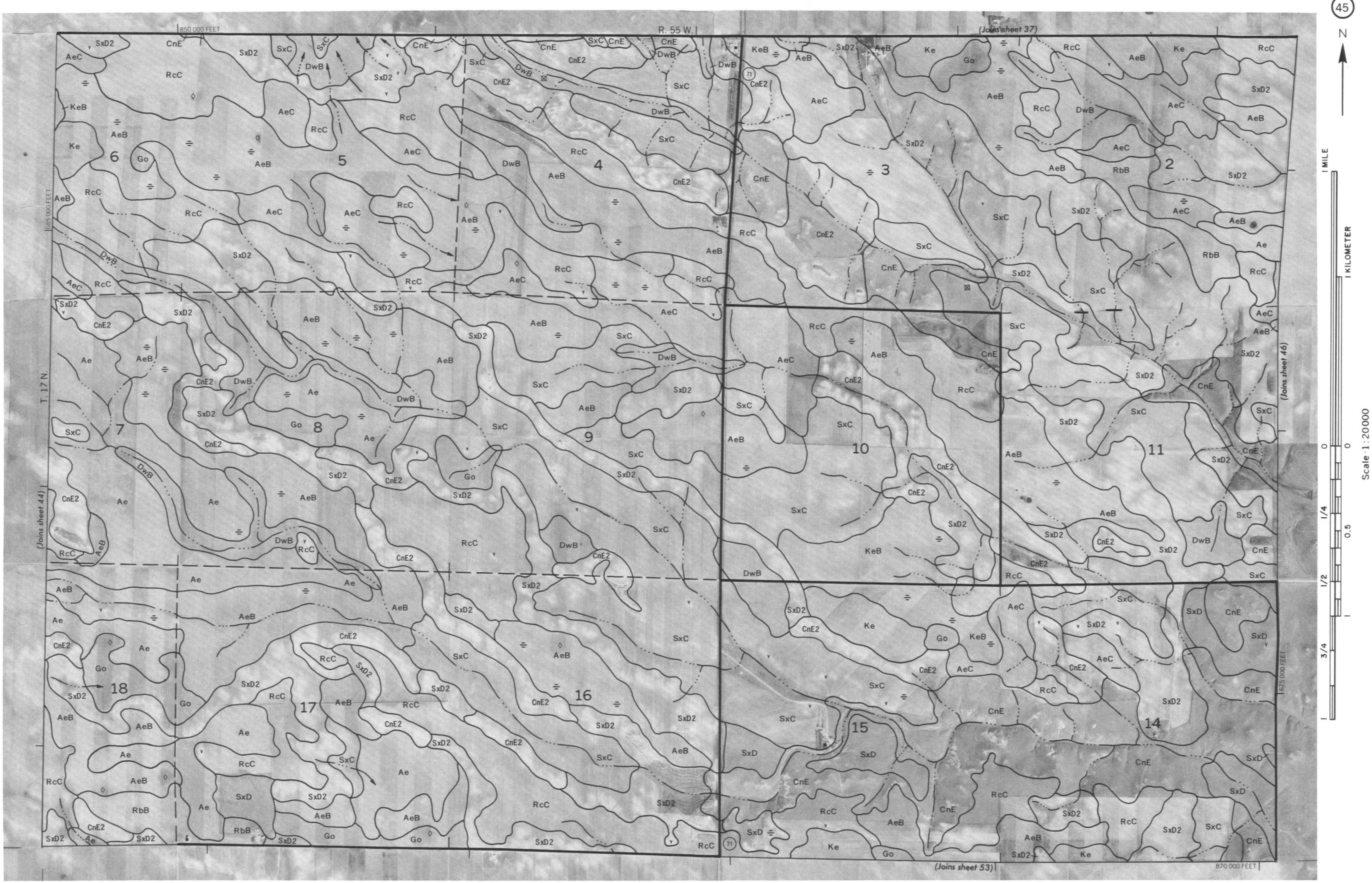

40
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 32)
(Joins sheet 39)
(Joins sheet 48)
R. 53 W.
T. 18 N.
940 000 FEET
700 000 FEET
690 000 FEET
920 000 FEET
Hackberry
Creek
MORRILL
COUNTY
21
22
23
24
25
26
27
28
33
34
35
36

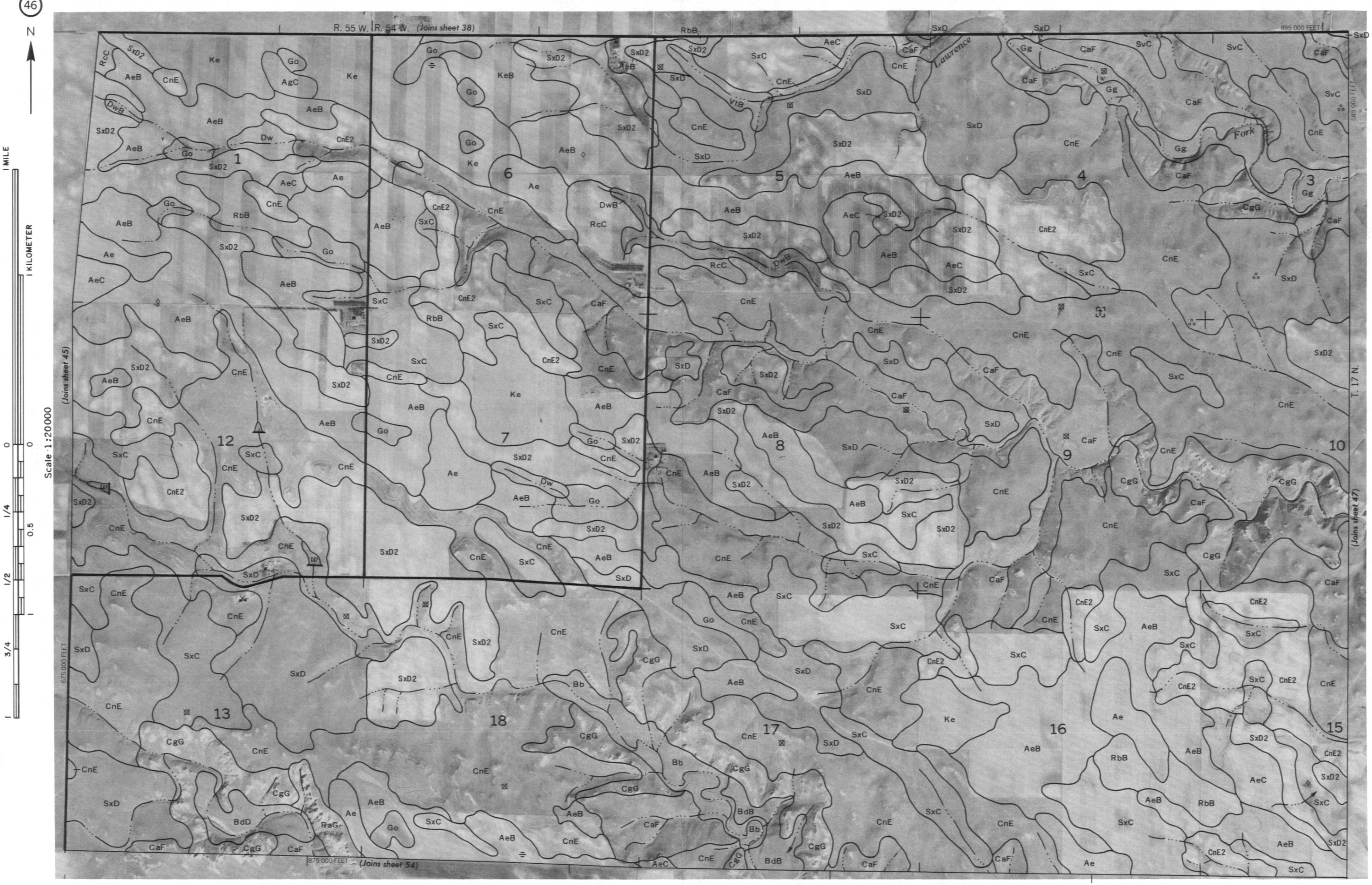

41
N
(Joins sheet 33)
R. 58 W.
755 000 FEET
690 000 FEET
T. 17 N.
WYOMING
LARAMIE COUNTY
(Joins sheet 42)
680 000 FEET
(Joins sheet 49)
775 000 FEET
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0.5
Scale 1:20000
6
5
4
3
2
7
8
9
10
11
18
17
16
15
14


N
(Joins sheet 34)
R. 58 W.
R. 57 W.
800 000 FEET
690 000 FEET
T. 17 N.
(Joins sheet 43)
(Joins sheet 41)
680 000 FEET
780 000 FEET
(Joins sheet 50)
Rocky
Hollow
Rocky
Hollow
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1

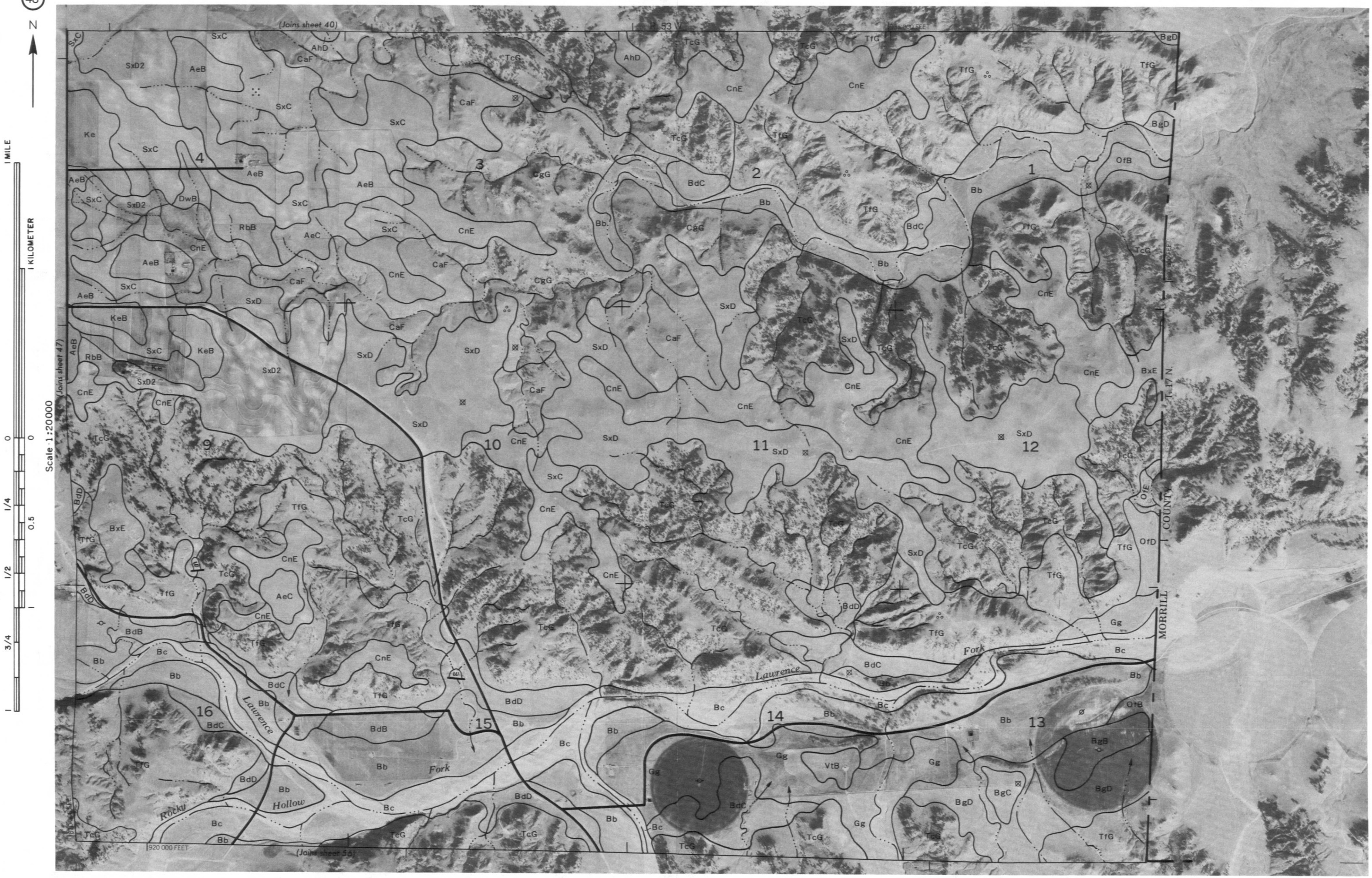

43
N
(Joins sheet 35)
(Joins sheet 44)
(Joins sheet 51)
(Joins sheet 42)
R. 57 W. | R. 56 W.
T. 17 N.
805 000 FEET
690 000 FEET
675 000 FEET
820 000 FEET
Rocky Hollow
1 MILE
1 KILOMETER
Scale 1:20000


44
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 36)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 52)
R. 56 W.
R. 55 W.
T. 17 N.
845 000 FEET
685 000 FEET
675 000 FEET
825 000 FEET
Rocky
Hollow
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18


45
N
850 000 FEET
R. 55 W.
(Joins sheet 37)
685 000 FEET
T. 17 N.
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 53)
870 000 FEET
675 000 FEET
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0
0.5
Scale 1:20000

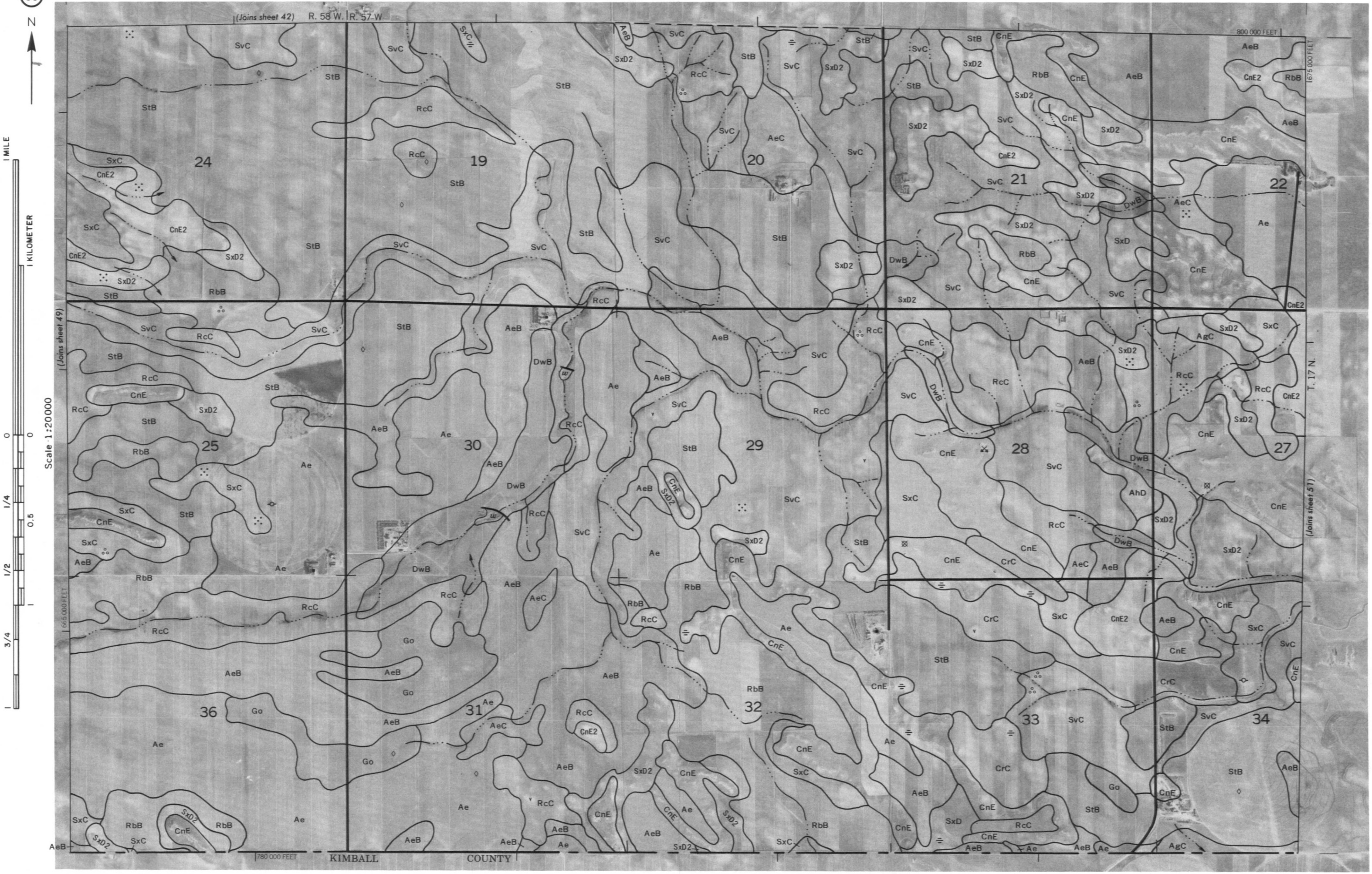

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
R. 55 W. | R. 54 W.
(Joins sheet 38)
895 000 FEET
685 000 FEET
T. 17 N.
(Joins sheet 47)
(Joins sheet 45)
675 000 FEET
875 000 FEET
(Joins sheet 54)
Lawrence
Fork
1
2
3
4
5
6
7
8
9
10
12
13
15
16
17
18

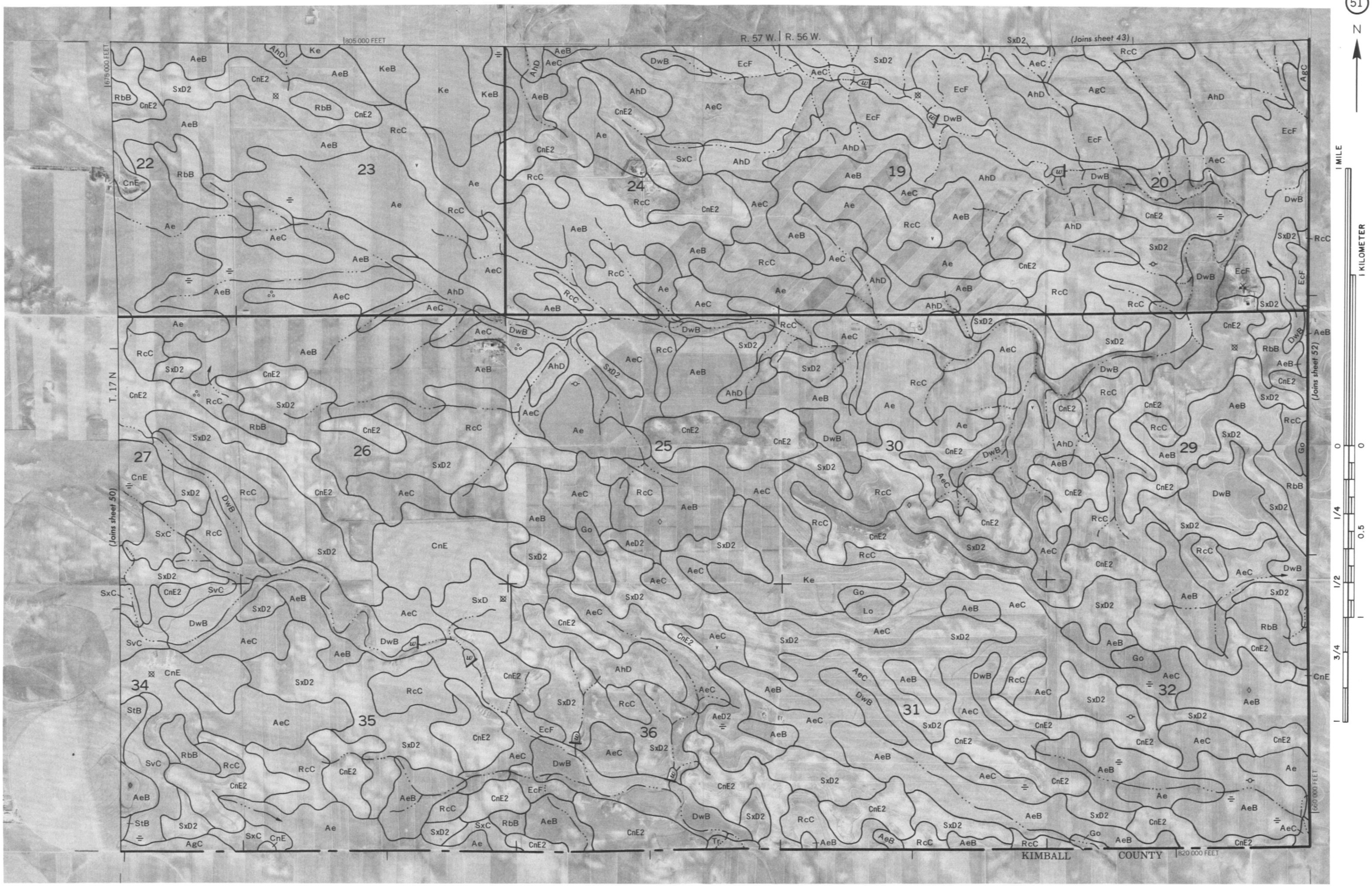

47
N
(Joins sheet 39)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 55)
R. 54 W.
R. 53 W.
T. 17 N.
900 000 FEET
685 000 FEET
915 000 FEET
Lawrence
Fork
Lone Pine Springs
Lone Pine Butte
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
0.5

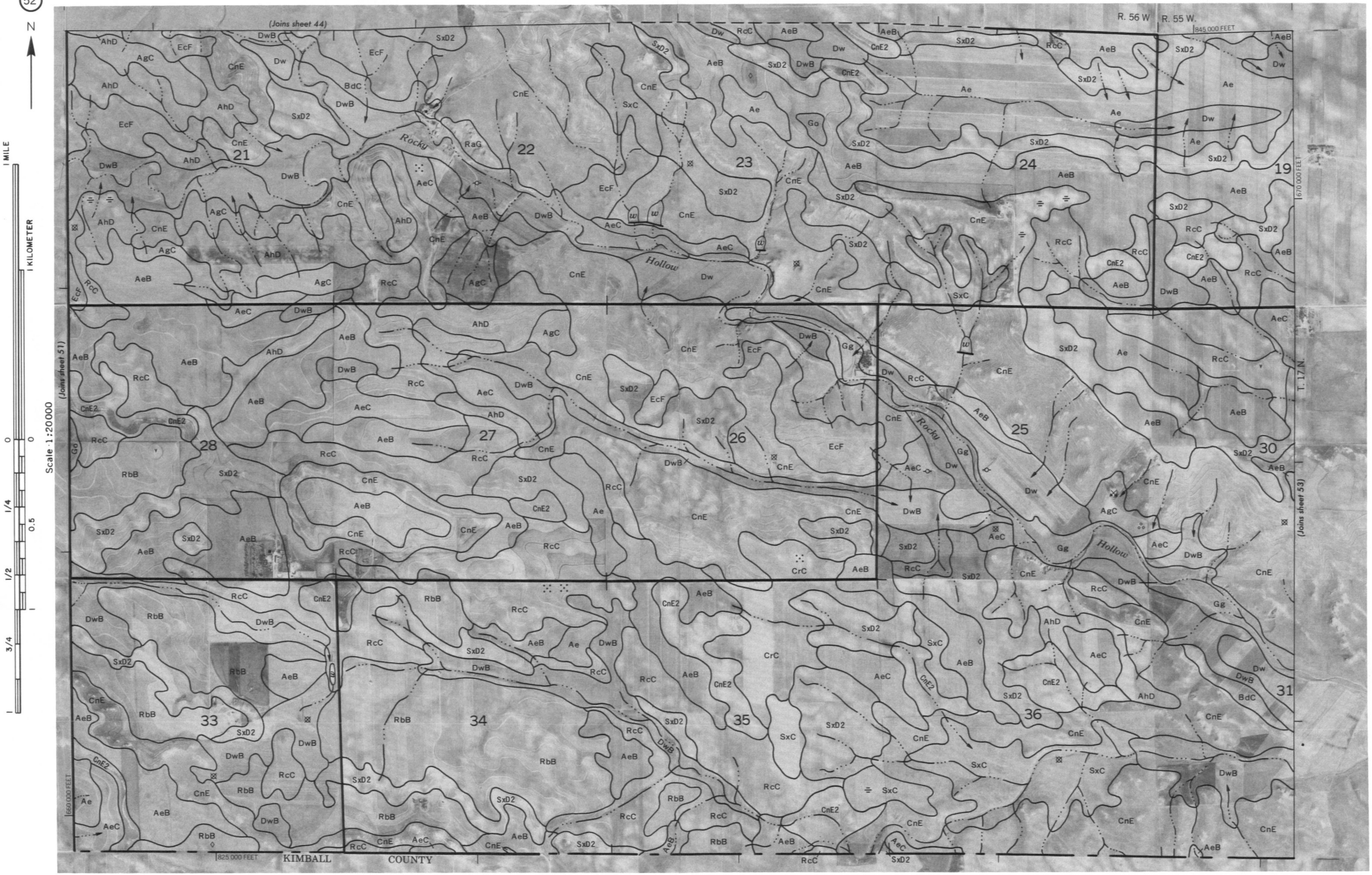

N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 40)
(Joins sheet 47)
(Joins sheet 56)
R. 53 W.
T. 17 N.
MORRILL COUNTY
920 000 FEET
Lawrence Fork
Rocky Hollow
SxC
SxD2
AeB
AhD
CaF
TcG
AhD
TcG
TfG
BgD
Ke
SxC
CnE
CnE
TfG
TfG
CaF
BgD
4
3
2
1
OfB
AeB
CgG
BdC
Bb
SxC
SxD2
DwB
RbB
AeC
CnE
CaF
CnE
CgG
CaF
SxD
CaF
SxD
KeB
RbB
SxD2
CnE
TcG
9
10
11
12
BxE
TfG
AeC
CnE
BdD
BdB
Bb
Bc
16
BdC
15
14
13
BdB
Fork
Gg
VtB
BgC
BgB
BgD
OfD
OfE
TfG

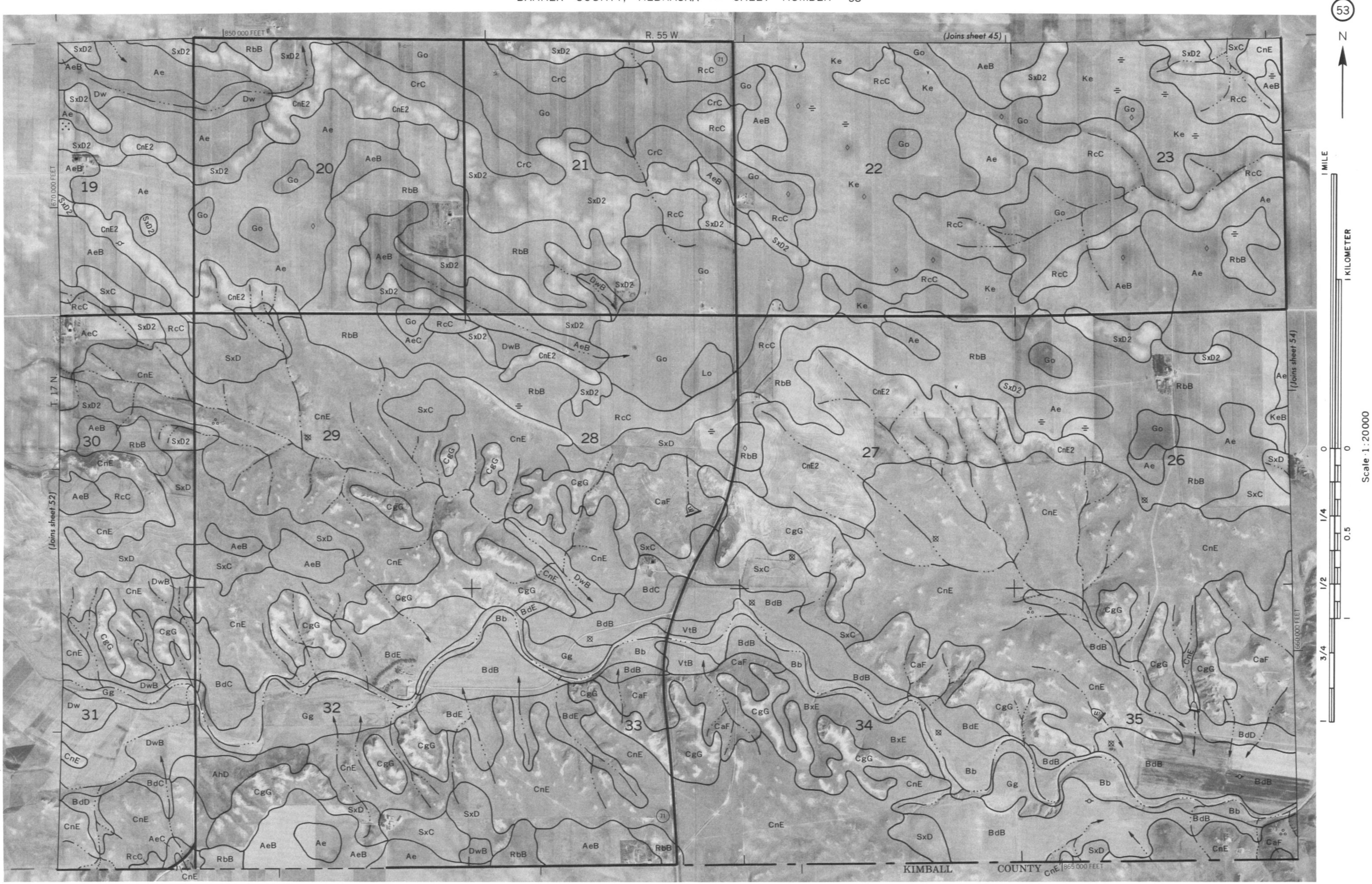

49
N
(Joins sheet 41)
(Joins sheet 50)
R. 58 W
T. 17 N.
755 000 FEET
775 000 FEET
675 000 FEET
665 000 FEET
WYOMING
LARAMIE COUNTY
KIMBALL COUNTY
1 MILE
1 KILOMETER
Scale 1:20000
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35

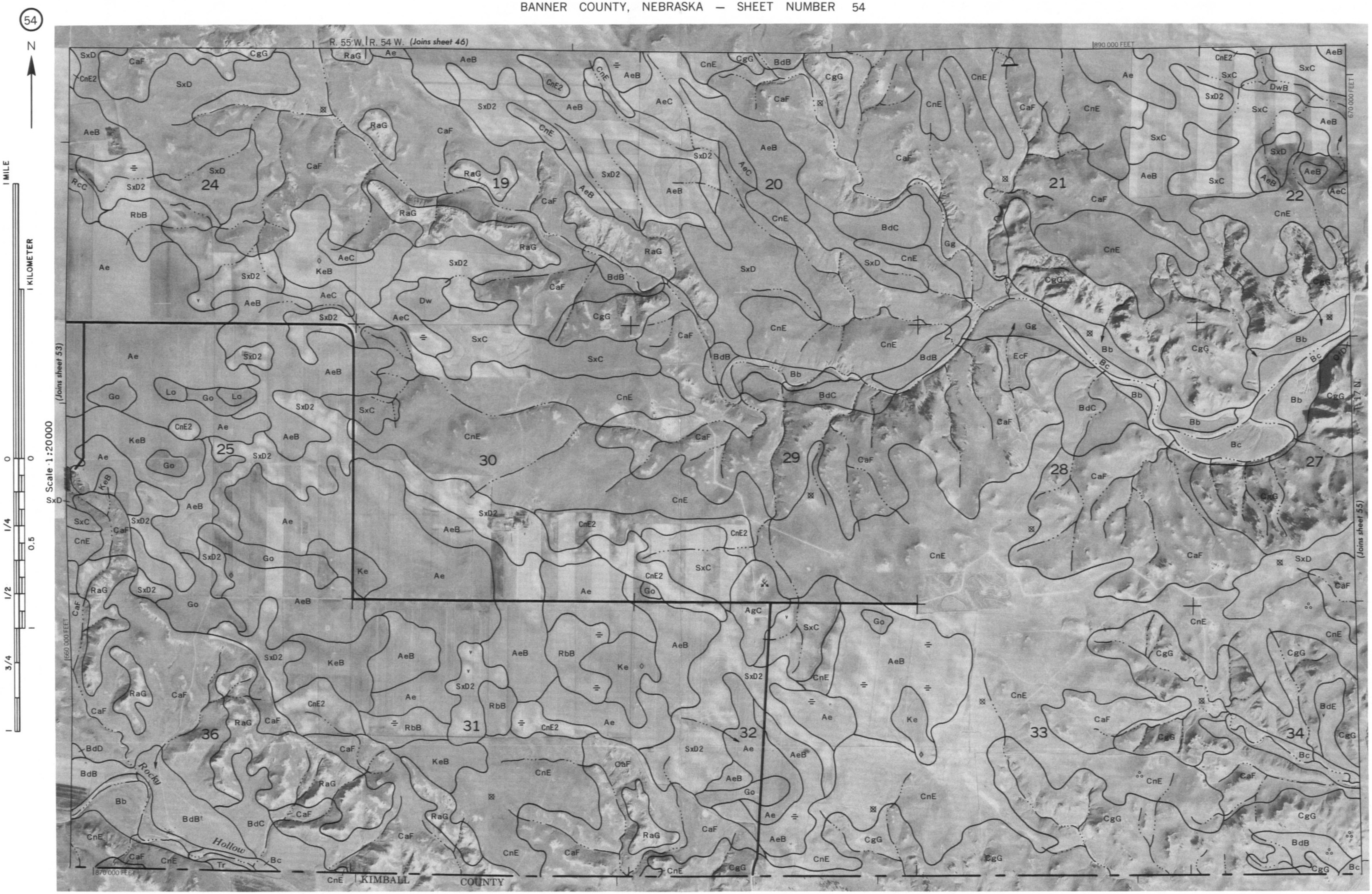
50


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 42)
R. 58 W. | R. 57 W.
800 000 FEET
675 000 FEET
(Joins sheet 49)
(Joins sheet 51)
T. 17 N.
665 000 FEET
780 000 FEET
KIMBALL
COUNTY
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
StB
SvC
RcC
SxD2
CnE
CnE2
AeB
AeC
Ae
DwB
RbB
SxC
AgC
AhD
CrC
Go
SxD


51
N
R. 57 W.
R. 56 W.
805 000 FEET
675 000 FEET
(Joins sheet 43)
(Joins sheet 52)
(Joins sheet 50)
T. 17 N.
KIMBALL COUNTY
820 000 FEET
660 000 FEET
1 MILE
1 KILOMETER
Scale 1:20000
22
23
24
19
20
25
26
27
29
30
31
32
34
35
36


52
N
1 MILE
1 KILOMETER
Scale 1:20000
(Joins sheet 44)
(Joins sheet 51)
(Joins sheet 53)
R. 56 W.
R. 55 W.
T. 17 N.
845 000 FEET
670 000 FEET
660 000 FEET
825 000 FEET
KIMBALL COUNTY
Rocky Hollow
21
22
23
24
19
25
26
27
28
30
31
33
34
35
36


53
N
R. 55 W.
T. 17 N.
(Joins sheet 45)
(Joins sheet 54)
(Joins sheet 52)
850 000 FEET
670 000 FEET
660 000 FEET
865 000 FEET
KIMBALL COUNTY
19
20
21
22
23
26
27
28
29
30
31
32
33
34
35
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0.5


54
N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
R. 55 W. | R. 54 W. (Joins sheet 46)
890 000 FEET
670 000 FEET
660 000 FEET
870 000 FEET
(Joins sheet 53)
(Joins sheet 55)
T. 17 N.
24
19
20
21
22
25
30
29
28
27
36
31
32
33
34
Rocky
Hollow
KIMBALL
COUNTY


55
N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0
0.5
1
Scale 1:20000
895 000 FEET
670 000 FEET
665 000 FEET
915 000 FEET
R. 54 W. | R. 53 W.
T. 17 N.
(Joins sheet 47)
(Joins sheet 54)
(Joins sheet 56)
KIMBALL COUNTY
Hollow
Rocky
19
20
22
23
24
25
26
27
29
30
31
32
34
35
36
AeB
AeC
Ae
AhD
Bb
Bc
BdB
BdC
BdD
BdE
BxE
CaF
CgG
CnE
CnE2
CrC
DwB
EcF
Gg
Go
KeB
KeC
OfD
OfE
SxC
SxD
SxD2
TcG
TfG
w


N
1 MILE
1 KILOMETER
Scale 1:20000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 48)
R. 53 W.
(Joins sheet 55)
Rocky
Hollow
T. 17 N.
CHEYENNE
COUNTY
KIMBALL
COUNTY
665 000 FEET
920 000 FEET
21
22
23
24
25
26
27
28
33
34
35
36
TcG
BdD
Bc
Bb
BdB
BdC
BxE
OfD
EcF
OfE
TfG
BgD
Gg
SxD
SxD2
SxC
CaF
CgG
CnE
AhD
BeE
AeD2
AeC
AeB
SvC
SvC
Dw
DwB
Go
StB
RbB
KeB
Lo